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SCIENCE IN AMERICA AND MODERN METHODS OF SCIENCE.*

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Fellow-associates:— We meet again at a point far distant from the one where we gathered last year, to interchange social greetings and scientific thoughts, and to form plans for future labor and usefulness. Fifteen hundred miles divide Dubuque from Portland, as the bird flies, and yet that extent of country and much more are all our own. Its living and dead treasures, with its rocks and its soil, furnish abundant study for our men of science, from which to draw rich stores of knowledge, and to direct the capital of the country to new sources of wealth.

As the members of the American Association for the Advancement of Science hold their session for a few days only, and occupy a portion of their time in interchange of social greetings among themselves and with the inhabitants of the city where they meet, that critical examination of papers communicated to the Association cannot be entered upon that otherwise would be, nor can the length of the communications and discussions be easily limited. In fact, while it would be desirable to supervise these matters more fully, such supervision is surrounded with so many difficulties that those whose business it is are forced to content themselves with an imperfect discharge of their duty.

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This too often gives rise to unjust criticisms on the part of the press, whose reporters attend the meetings with the same views as those with which they would enter a learned body of scientific men, who meet at stated periods, with short intervals, and where both time and sound criticism are bestowed upon such investigations as are communicated.

This association, in some sense, is to be regarded as an annual scientific *fête*, where the interchange of ideas outside the audience-room suggests as much, if not more, stern matter for reflection as the communications which may be read; the minds of men that have been on the stretch during the year are relaxed, and fresh pabulum and new vigor are furnished for the coming year.

It sometimes happens that many persons who attend our meetings gather erroneous impressions from them as to what the scientific men of the country are doing, and go away questioning themselves whether or not scientific societies and associations have, after all, done much for science; and conclude that while the men forming them have made many important investigations, and published them for the benefit of succeeding ages, it is to practical and obscure persons that the world is indebted for its great discoveries.

I allude to this here, as it is but recently that I have seen this assertion made in an article calculated to attract the attention of the masses, and the author of that article illustrates the fact by citing Clarke, Fulton and Morse. Now, while all honor is due to those men of skill and genius, I would ask — Who gave them the fulcrums on which they placed their levers, by which they have wrought so much in practical science and the arts of life? *It was pure science.* Without its aid Clarke's practical skill would have failed him in constructing his huge astronomical lenses; it is to the experiments on latent heat in the laboratory of Black that we owe the present steam-engine, and without which Fulton would never have ruffled the water of our rivers nor stemmed the winds of the ocean; and without the scientific thought and the grand, though inconspicuous, experiments of Galvani, Volta, Oersted, Faraday, Henry and others, no one would have ever dreamt of making a swift messenger of the lightning.

My thoughts on this subject have led me to reflect much upon scientific training in this country, both for those wishing to pursue science as a profession as well as for those desiring it only for general education.

There are, no doubt, serious errors in the scientific training that students undergo at our various universities and schools, which are too much in the habit of making short cuts in going over the fields of science. We are in fact a fast people, as it is commonly expressed, and are not content to devote patient and laborious study to pursuits that can only be mastered in that way. A short time ago, a physician writing on this same error in relation to his profession justly said that, while we have shortened distance by the railroad and the telegraph, the road to learning is the same as it was in the days of Socrates and Plato.

The student is restless to become instructor, the lecture-room enticing him from his studies before they are half mastered; consequently his instruction to others is both meagre and imperfect.

Our vast material interests draw the students from their laboratories to undertake the conducting of mines and other important works. The consequence is, bad economy reigns in most of them; and if it were not for the patient submission of the people of this country to high prices, many an enterprise would have to suspend operations.

But it is at the door of the educational institutions themselves that the greatest blame is to be placed. First of all, our universities (or rather our so-called universities) are too numerous. Nowadays every college must have a scientific school attached, else it is not thought complete; and the number of professors competent to fill the scientific chairs in all these institutions could not be easily supplied in this country. Were it possible, it would be far better to have fewer scientific schools, and to establish them on the broadest basis, with most liberal endowments, so that instruction could be imparted at some mere nominal cost to the student, and to make their examinations of such a standard that the indorsement of these several schools would be a passport to the bearer of it wherever he might seek for employment in pure science or in its applications. And furthermore, by a system of well-endowed scholarships, to retain those specially gifted with taste and talent for pure science to devote their first years to labor in that direction. Owing to these defects in our system of scientific education, American science is frequently reproached as being very deficient in pure and patient research.

Now, while admitting that our scientists have fallen short of what might have been expected of them, no one can deny that a

vast amount of scientific labor has been accomplished in this country from the time of Franklin to the present day; and in the application of science to the arts we are not far behind the most advanced nation of our own time.

I know that American scientists are looked upon by their European colleagues as in some sense piratical in their nature, simply capturing the hard-earned labors of others, applying the great truths and discoveries in science others have brought to light, and not evolving them by hard and laborious study and experiment. This is to some extent true, for the labors required of our professors, who have educated and trained minds, in the countless colleges that dot the land, are so onerous that no time is given them for the exercise of original thought and investigation.

What can a physicist, a chemist or naturalist, do who has three or four classes to teach, usually in the most elementary part of their studies? The very labor unfits him for that free exercise of the mind which leads to new ideas and discoveries. He becomes an educational drudge instead of an intellectual scientist; and whatever his intrinsic merits may be, he is in most cases sustained, pecuniarily, no better than those engaged in the commonest pursuits of life, being at the same time restricted in intellectual resources — such as books, scientific transactions, apparatus, etc.

I will, however, just here make one other plea for our men of science against any unjust comparison with those across the Atlantic. It is this. Our country is a new one, of most peculiar and wonderful features of surface, of soil, and of climate, and of untold and fabulous wealth within its bowels; it beckons every man to fortune; and with such ease are wealth and honors snatched from its overflowing lap that even men who love and honor science are drawn off their direct paths into by-ways and other pursuits, and too often leave behind them the scientific toga, which is never again assumed. In Europe it is otherwise; no temptations of this kind beset the scientist, and he delves into scientific lore, acquiring great ideas and telling them to the world, exciting their wonder; and even then the honors they acquire only bind them faster to their closets, for they are not tempted as we are.

In later years the liberality of wealthy patrons of learning and science has done much to advance pure science in this country by enabling the young and enthusiastic pursuers after Nature's secrets to give full scope to their tastes, and thus has opened to them new

fields of research so enticing that their entire lives may become absorbed in them. This is increasing every day in our country, and before very long there will be such inducements to offer to her greater minds to devote their lives to pure science that America will become as prolific in new scientific ideas and discoveries as Europe.

Let us ever bear in mind that it is *abstract scientific ideas which underlie, in these modern days, all discoveries conducive to man's progress*, from the making of a pen to the construction of a telescope; or, as Herbert Spencer well expresses it, "each machine is a theory before it becomes a concrete fact." The man of pure science paves the way, erects the mile-stones, and puts up the guide-post for the practical man. The world, long dormant to this great truth, is fast waking up to its acknowledgment; as those words *Cui bono?* (the touch-stone used by the so-called practical men) are only heard now in faint whispers, where they were formerly sounded most clamorously whenever any scientific discovery was announced.

This does not arise from any change in men; they are the same now as they were in the days of Galvani, who was doubtless regarded as a frivolous fellow, engaged in his daily experiments over the convulsions of the muscles in a frog's leg when brought in contact with two metals; but, while mankind has not changed, Galvani's experiment has, and instead of a frog being convulsed by the electric force then discovered it is a world that is now convulsed, as this same electricity flashes through those nerves of metal that stretch across land and river and bury themselves deep beneath the oceans of our globe; battles are fought, victories announced, commerce controlled, and, I am sorry to say, tyranny abetted, by that wonderful agent whose phenomena in their incipiency invited the ridicule of the ordinary observer.

Science at the present day commands the respect of the world; nations, looking up to it, seek its advice at all times, and move in no material enterprises without consulting its oracles; yellow-covered literature is beginning to find a rival in well-conducted popular scientific journals and popular treatises on the various branches of science.

As an association of American scientists, we are looked upon as men representing science in all its bearings upon the physical and mental world, and some even go so far as to suppose that we

would arrogate to represent its bearings equally upon the spiritual world. This being the case, it behooves us to guard well our thoughts, words, and acts, else they may do science and ourselves injustice, and misrepresent both Nature and Nature's God.

We are all searchers after truth: but let us be careful that we do not mistake what truth is, and be beguiled into following some fatal error which has simply borrowed the garb of truth, and completely enveloped itself in it, so as to hide its own deformity. Error has often glimmer enough to dazzle the sickly eye of the enthusiast; truth itself shines with sufficient brightness to be seen by the most jealous among scientists.

While it would not be out of place to review the activity of American science for the benefit of the general public, yet it would occupy too much time, and I will merely refer to it to show that our Government is fully alive to the value of well-directed scientific labors. The Government never hesitates to encourage the most thorough investigations by scientific men into all matters that are likely to benefit the people or advance those great scientific investigations which are of a more abstract character. Witness the care and liberality with which it encourages that corps of scientists engaged in the gigantic enterprise of the coast survey in all its various departments; its liberal appropriation of money and means to observe those great astronomical phenomena, such as solar eclipses, the transit of Venus, etc., which, while they may not be attended with any immediate material advantage to the Government, yet serve to instruct our people in those higher and nobler aspirations after great natural truths which must inevitably result in unfolding to us the riches of our land, teeming with every diversified beauty of mountain, valley, and plain, seas, lakes, and rivers, and, beneath her surface, with all the variety of wealth that Nature seems to have been able to produce. While the older portions of the world are making serious calculations, and even looking forward with gloomy forebodings to the time when their soil and rocks will cease to give wealth to toil, our soil and our rocks are but just being turned up to reveal wealth tenfold greater than the world ever knew before. But in the midst of all this abundance let us feel assured of one thing; it is so placed that no sluggard can stretch forth his hand and partake of it.

The wealth of America means toil. And perhaps in this we are even more blessed than we sometimes are disposed to think;

for the rich soil which covers such a vast proportion of our country, some of the states of which, like Illinois, with 55,000 square miles of surface, have hardly a barren acre, yet we can pluck nothing from it; it is not like the tropical forest, from which the indolent natives may gather their food, and live a life of inertia almost akin to that of the beasts that wander through its rich foliage. In this country the arm must be stretched forth, the forest felled, the ground ploughed, provision made against the inclemency of varying seasons, but when this is done what a glorious return!—rich and luxurious crops, abundant harvests. Then, by the numerous navigable streams and favorable surface for roads, a ready market is afforded for the farmer's surplus. And when we go beneath the soil and mine the rock it is not only the uncertain gold and silver, but the sure coal and iron that reward toil, and from the very nature of the labor improve those engaged in it.

As followers and patrons of science we must keep in view the wants and wishes of the people. Sometimes the people themselves, as well as their representatives, are slow to appreciate our labors; but experience has proved that they give way at last to the patient and judicious perseverance of men of science, who in some way or other show that they are not mere abstractionists, but that what they do has practical bearings, and therefore renders the people more powerful both at home and abroad. Science furnishes, so to speak, the raw material out of which all the progress of modern nations is constructed. To use the words of one of our Nestors of science: "It is only in recent times that the value of scientific research began to be felt; and I hope to live, old as I am, long enough to see the community, the enlightened community which has become my second fatherland, appreciate what science is doing for the general prosperity, and then contribute to the necessities of science with that generous liberality which characterizes the acts of American people."

Thus much has been said in reference to science in America, acknowledging our shortcomings and attempting to correct certain erroneous impressions, both in America and abroad, in regard to the labor of scientists in this country. It may appear an attempt on my part to urge undue excuses; such certainly is far from my intention; which is to do simple justice to those prosecuting science under more or less disadvantageous circumstances.

I now pass to the second part of my discourse—the methods of modern science—the caution to be observed in pursuing it, if we do not wish to pervert its end by too confident assertions and deductions.

It is a very common attempt nowadays for scientists to transcend the limits of their legitimate studies, and in doing this they run into speculations apparently the most unphilosophical, wild, and absurd; quitting the true basis of inductive philosophy, and building up the most curious theories on little else than assertion; speculating upon the merest analogy; adopting the curious views of some metaphysicians, like Edward Von Hartmann; striving to work out speculative results by the inductive method of natural science. To me this appears a perversion of Bacon's philosophy, and we cannot wonder that one adopting such views, whatever his claim to genius may be, soon cuts loose from all physical reasoning and becomes involved in the most transcendental and to all appearances absurd opinions, which, however clear to the author, are strange and unintelligible to others; and if at any one time we believe we have caught the conception of the author, this impression is only momentary, and we give up in despair, realizing that we cannot follow his intellectual ecstasies; for, in the language of Tyndall, they are even "unthinkable." Those engaged in such speculations are very commonly found in bitter conflict with each other, forcing on us the belief of the saying of D'Alembert, that "when absurd opinions become inveterate it sometimes becomes necessary to replace them by other errors, if nothing better can be done."

This extreme metaphysical philosophy is referred to for the reason that many scientists, ranking as sober, earnest laborers after truth, are caught dealing in such philosophy in their method of investigation, and sometimes, quite unconsciously to themselves, forgetting that "science is only an accurate record of the processes of nature; that its laws are only generalizations of its observations, and not a declaration of an inherent necessity; and that one of its observations is the uniformity of natural sequence."

I am one of those who believe that everything must give way to the laws of nature; but then we must master these laws, and be sure that we have done this before either interpreting phenomena by them or venturing into the realm of speculation.

As has been already remarked, men are to-day just what they have ever been. As bright intellects and as great philosophers lived two or three thousand years ago as do now; their minds sought out the same great truths that we are searching for in these days, and they sought for them by the lights with which they were surrounded. In those earlier ages poetry, sculpture, architecture, and even some facts belonging to natural history (things that belonged either to the imagination or to the eye), arrived at as high a degree of perfection as perhaps they ever will; for the two senses which appreciate the ideal and the real were as perfect then as now.

But when man was called upon to labor in fields where the imagination and the eye aided him but little or not at all, then the discoveries in these fields and their interpretations call for other means for arriving at results. In modern days we attempt to be guided by the clear light of inductive reasoning which we may think we are employing, when too often it is the very smoky torch of analogy that is being used; and this fact serves to explain why it is that some of the most brilliant philosophers of comparatively modern days are only remembered by their names — as, for example the great French philosopher Descartes, whom Dugald Stewart says "is much better known to the learned of our day by the boldness of his exploded errors than by the profound and important truths contained in his works."

And such an example as this is of great value to the reflective mind, teaching caution, and demonstrating the fact that, while the rules by which we are guided in scientific research are far in advance of those of ancient days, we must not conclude that they are perfect by any means. In our modern method of investigation how many conspicuous examples of deception we have had in pursuing even the best method of investigation! Take, for instance, the science of geology from the time of Werner to the present day. While we always thought we had the true interpretation of the structural phenomena of the globe as we progressed from year to year, yet how vastly different are our interpretations of the present day from what they were in the time of Werner! In chemistry the same thing is true. How clearly were all things explained to the chemist of the last century by the doctrine of Phlogiston which in the present century receives no credence, while chemical phenomena are now viewed in an entirely different light!

Lavoisier, in the latter part of the last century, elucidated the phenomenon of respiration and the production of animal heat by one of the most beautiful of theories, based, to all appearances, upon well observed facts; yet at the present day more delicate observations, and the discovery of the want of balance between the inhaled oxygen and exhaled carbonic acid subverted that beautiful theory, and we are left entirely without one. It is true we have collated a number of facts in regard to respiration, molecular changes in the tissues, etc., all of which are recognized as having something to do with animal heat; still it is acknowledged that we are incapable of giving any concrete expression to the phenomenon of respiration and animal heat as Lavoisier did eighty or ninety years ago.

Electricity is the same now as it has ever been, yet it was once spoken of as a fluid, then as a force, now as an energy readily convertible into caloric or mechanical energy; and in what light it will be considered fifty years hence no one can predict.

Now what I desire to enforce here is that, amid all these changes and revolutions of theories, so called, it is simply man, the interpreter, that has erred, and not Nature; her laws are the same; we simply have not been able to read them correctly, and perhaps never shall be.

What, it may be asked, are we to do then? Must we cease theorizing? Not at all. The lesson to be learned from this is, to be more modest in our generalizations; to generalize as far as our carefully made out facts will permit us, and no farther; to check the imagination and not to let it run riot and shipwreck us upon some metaphysical quicksand.

The fact is, it becomes a question whether there is such a thing as a pure theory in science. No true scientific theory deserves the name that is not based on verified hypotheses; in fact, it is but a concise interpretation of the deductions of scientific facts. Dumas has well said that theories are like crutches, the strength of them to be tested by attempting to walk with them. And I might farther add that very often scientists, who are without sure-footed facts to carry them along, take to these crutches.

It is common to speak of the theory of gravitation, when there is nothing purely hypothetical in connection with the manner in which it is studied; in it we only see a clear generalization of observed laws which govern the mutual attraction of bodies. If at

any time Newton did assume an hypothesis, it was only for the purpose of facilitating his calculations. "Newton's passage from the falling of an apple to the falling of a moon was at the outset a leap of the imagination;" but it was this hypothesis, verified by mathematics, which gave to the so-called theory of gravitation its present status.

In regard to light, we are in the habit of connecting with it a pure hypothesis; viz., the impressions of light being produced by emission from luminous bodies, or by the undulation of an all-pervading attenuated medium; and these hypotheses are to be regarded as probable so long as the phenomena of light are explained by them, and no longer. The failure to explain one single well-observed fact is sufficient to cast doubt upon or subvert any pure hypothesis, as has been the case with the emission theory of light, and may be the fate of the undulatory theory, which, however, up to the present time serves in all cases.

A theory or scientific speculation, to possess any great weight, must receive universal assent by those minds capable of investigating the subject. Thus the undulatory theory of light is universally accepted as representing the true nature of the operation of light, so far as we are now able to interpret its phenomena.

Zoölogists equally learned will agree perfectly as regards the physical structure of an ape and a man, and thus far their results are entitled to universal acceptance; but some of the same zoölogists, by the exercise of the imagination and ingenious analogical reasoning, deduce the man from the ape, while the others cannot see nor recognize any such transformation. In this way both classes present themselves to the curious world, and gather around them supporters; and, like too many cases in our courts of law, the greatest number are convinced not so much by the law or justice of the case, as by the ingenuity and special pleading of the legal advocates.

It is not my object to criticise the speculations of any one or more of the modern scientists who have carried their investigations into the world of the imagination; in fact, it could not be done in a discourse so limited in time as this, and only intended as a prologue to our present meeting. But in order to illustrate this subject of method more fully I will refer to Darwin, whose name has become synonymous with progressive development and

natural selection, which, as we had thought, died out with Lamarck fifty years ago.

In Darwin we have one of those philosophers whose great knowledge of animal and vegetable life is only transcended by his imagination. In fact, he is to be regarded more as a metaphysician with a highly-wrought imagination than as a scientist, although a man having a most wonderful knowledge of the facts of natural history.

In England and America we find scientific men of the profoundest intellects differing completely in regard to his logic, analogies and deductions; in Germany and France the same thing — in the former of these countries some speculators saying that "his theory is our starting-point" and in France many of her best scientific men not ranking the labors of Darwin with those of pure science.

Darwin takes up the law of life and runs it into progressive development. In doing this he seems to me to increase the embarrassment which surrounds us on looking into the mysteries of creation. He is not satisfied to leave the laws of life where he finds them, or to pursue their study by logical and inductive reasoning. His method of reasoning will not allow him to remain at rest; he must be moving onward in his unification of the universe. He started with the lower orders of animals, and brought them through their various stages of progressive development until he supposed he had touched the confines of man; he then seems to have recoiled, and hesitated to pass the boundary which separated man from the lower orders of animals; but he saw that all his previous logic was bad if he stopped there, so man was made from the ape (with which no one can find fault, if the descent be legitimate). This stubborn logic pushes him still farther, and he must find some connecting link with that most remarkable property of the human face called expression; so his ingenuity has given us a very curious and readable treatise on that subject. Yet still another step must be taken in this linking together man and the lower orders of animals; it is in connection with language; and before long it is not unreasonable to expect another production from that most wonderful and ingenious intellect on the connection between the language of man and the brute creation.

Let us see for a moment to what this reasoning from analogy would lead us, if applied to chemical science, which investi-

gates a great variety of compounds that exhibit most curious analogies in all their properties. Take for instance soda and potash — how identical in almost all their properties, and their compounds arraying themselves in identically the same form, defying almost all the senses to detect their difference: if they be brought into relation with other elements, they associate themselves with these elements in identically the same way. The same is true in relation to baryta and strontia, or chlorine, bromine and iodine; the last three elements even show most curious numerical relations in regard to their combining proportions. And then when we pass to the mineral kingdom, what a wonderful property is that isomorphism in the chemistry of Nature's operations!

The chemist, with all these facts before him, has as much right to revel in the imaginary formation of sodium from potassium, or iodine and bromine from chlorine, by a process of development, and call it science, as the naturalist has to revel in many of his wild speculations, or the physicist who studies the stellar space to imagine it permeated by mind as well as light — mind such as has formed the poet, the statesman, or the philosopher.

Yet any chemist who would quit his method of investigation, of marking every foot of his advance by some indelible imprint, and go back to the speculations of Albertus Magnus, Roger Bacon, and other alchemists of former ages, would soon be dropped from the list of chemists and ranked with dreamers and speculators.

To prove the truth of my assertion, that this is the legitimate result of this school of philosophy, I will quote from one of its disciples, F. W. Clarke. He says: "When one is fairly started on a line of thought it is hard to come to an end. If we assume an hypothesis to be true, a hundred others rush in upon the mind and demand consideration. We do not know but that the evolution of one element from another may be possible. The demonstrated unity of force leads us by analogy to expect a similar unity of matter. Those elements which seem to-day so diverse in character may be after all one in essence; at present it can neither be discarded as false nor accepted as true."

What is most remarkable in connection with the above opinion is that the author of it is commenting on matter, in connection with the spectroscope, an instrument whose very triumphs are based on the grand distinguishing lines in the elements of matter,

whether in the earth, sun, stars, or nebulæ, all telling the same dissimilarity and no coalescence.

Is this to be one of the methods of modern science, I would ask? While in our ignorance and short-sightedness we should be careful in pronouncing any assumption as possible or impossible, still there is no reason why these terms should have much or any weight in the study of science; for in the abstract all things in nature are possible, not from any demonstration, but simply because no one can assert an impossibility. What a mass of confusion science would become if we studied its possibilities! for then every conceivable possibility would be entitled to equal consideration. And we are not therefore surprised that the author last quoted should say, "So then we may proceed to theorize in the most barefaced manner, without quitting the legitimate domain of science."

Are we to introduce into science a kind of purgatory into which to place undemonstrable speculations, and keep them there in a state of probation, and say that science cannot discard a theory as false when it cannot be accepted as true? Science, which is preëminently the pursuit of truth, has but one course to pursue: it must either accept or reject what may be thrust upon it.

What I have said is, in my humble opinion, warranted by the departure Darwin and others have made from true science in their purely speculative studies; and neither he nor any other searcher after truth expects to hazard great and startling opinions without at the same time courting and desiring criticism; yet dissension from his views in no way proves him wrong — it only shows how his ideas impress the minds of other men. And just here let me contrast the daring of Darwin with the position assumed by one of the great French naturalists of the present day, Professor Quatrefages, in a recent discourse on the physical character of the human race. In referring to the question of the first origin of man he says distinctly that in his opinion it is one that belongs not to science; these questions are treated by theologians and philosophers: "Neither here nor at the Museum am I, nor do I wish to be, either a theologian or a philosopher. I am simply a man of science; and it is in the name of comparative physiology, of botanical and zoological geography, of geology and palæontology, in the name of the laws which govern man as well as animals and plants, that I have always spoken." And studying man as a

scientist, he goes on to say: "It is established that man has two grand faculties of which we find not even a *trace* among animals. *He alone* has the moral sentiment of good and evil; *he alone* believes in a future existence succeeding this actual life; *he alone* believes in beings superior to himself, that he has never seen, and that are capable of influencing his life for good or evil; in other words, *man alone is endowed with morality and religion.*"

And it may be added that Hartmann, a philosopher of another school, says, selection explains the progress in perfection of an already existing type within its own degrees of organization, but it cannot explain the passage from an inferior degree of organization to a superior one.

If Prof. Quatrefages be right in regard to the moral sentiment in man, then Darwin must be wrong in asserting the development of man out of that in which not a trace exists of what most preëminently constitutes a man; or he must satisfy himself with evolving the physical part of man out of the lower order of animals, and then by some creative force implanting within him these principles.

Our own distinguished naturalist and associate, Prof. Agassiz, reverts to this theory of evolution in the same positive manner, and with such earnestness and warmth as to call forth severe editorial criticisms, by speaking of it as a "mere mine of assertion," and of "the danger of stretching inferences from a few observations to a wide field," and he is called upon to collect "real observations to disprove the evolution hypothesis." I would here remark, in defence of my distinguished friend, that scientific investigation will assume a curious phase when its votaries are required to occupy time in looking up facts, and seriously attempting to disprove any and every hypothesis based upon proof, some of it not even rising to the dignity of circumstantial evidence.

I have dwelt longer on this one point than I had intended; but the very popular manner in which in recent years it has been presented to the public mind of all classes of society, and to persons of all ages, warranted a full notice in speaking of the importance of avoiding, as far as possible, undue speculation in connection with our method of scientific investigation.

Let me not be understood to underrate the brilliant ideas and great learning of those most distinguished men of the nineteenth

century, Darwin, Huxley and others. I am too great a respecter of both science and the pursuit of science ever to encourage by my example anything like dogmatism among scientific men. While arraying methods of study in other branches of science to combat those employed by the followers of the evolution hypothesis, I most willingly indorse what Tyndall says concerning it, viz: "I do not think the evolution hypothesis is to be flouted away contemptuously; I do not think it is to be denounced as wicked. Fear not the evolution hypothesis! it does not solve, it does not profess to solve, the ultimate mystery of the universe. It leaves in fact that mystery untouched." If it be grounded on truth, it will survive all attempts to overthrow it; if based on error, it will disappear, as many so-called scientific facts have done before. Science is a progressive study. It does not dogmatically pronounce itself as infallible; it is at all times ready to admit what has been once rejected, if it return clothed with truthful demonstration which science properly calls for as a passport to admission into its domain.

I would also caution my associates to avoid carefully what may be called the pride of modern science; for so rapid have been the discoveries of science during the last century, crowding upon us especially during the past twenty-five years, that we are apt to become bewildered and dazzled, and cry out in unbounded enthusiasm: Great is the god Science! it revealeth all things to us, and we will consecrate our talent and our time to its worship. The marvellous discoveries in chemistry, geology, electricity, light, etc., have lifted the veil that concealed from us so many of Nature's secrets that we are almost baffled in our attempt to systematize them. The wonderful organic compounds; the disinterring of curious records of past ages; the obedient and submissive lightning that carries our messages; that wonderful light, so quiet in its operations, yet so powerful to reveal the chemistry of the universe; and the conservation of force — all these, I say, bewilder the mind so that we revel in building bright air-castles, almost losing our mental equilibrium. Of all scientists of the present day the chemists perhaps have kept a more stable equilibrium than any other class, starting out with a fixed law to govern them in regard to what are considered elements, never in any instance tolerating the development or transmutation of one element out of another, however remarkable the analogy they may exhibit

in the material constitution of all known substances, and recognizing them as the same whether in the earth or in the sun.

I would, therefore, caution against too great enthusiasm, for we are far more ignorant than we sometimes suppose. In fact, true philosophy dictates to its followers humility, and that it is the province of ignorance to believe that it knows everything, while the philosopher is aware that he knows little or nothing.

While we are prying into space, and studying the matter, size, and movements of the heavenly bodies far beyond our own universe, we leave behind us a vast number of things that have baffled our scrutiny and defied both science and metaphysics. When we look at our bodies, without reference to the consciousness that is within, but merely studying what relates to our physical parts, how many things concerning it we have not discovered!

While occupied, the early part of this year, in reflecting upon the conservation of force and certain meteoric phenomena connected with the sun, my attention was frequently drawn to the small-pox that was then in the form of a violent epidemic around me. Seeing persons being vaccinated who had in their childhood been subjected to the same operation, and observing in the vast majority of cases the failure of the production of any effect, I asked myself the question: How are we to rank that mysterious agent which, when brought to bear upon the system, in however minute a quantity, not only permeates every fibre and cell in every part of the body, but is never lost? for when through years every particle of the body (with perhaps the exception of the teeth and a part of the bones) has been renewed over and over again, yet, as each particle gave place to a new one, this vaccine energy (if I may so call it) was imparted to the new matter, and so on through life. Here then was the conservation of a force as mysterious in its course and operation, and as hard to be understood, as that of motion, light, or any other of the recognized forms of the energies of matter.

Yes! after we have studied the heavens and all contained therein that the aided eye can reach, we shall yet have to descend to earth and study the every-day physical phenomena that are in and around men, finding even greater mysteries to unravel that meet our unaided senses every moment of our existence.

I come now to the last point to which I wish to call the attention of the members of the association in the pursuit of their in-

vestigations, and the speculations to which these give rise in their minds.

Reference has already been made to the tendency of quitting the physical to revel in the metaphysical, which, however, is not peculiar to this age, for it belonged as well to the times of Plato and Aristotle as it does to ours. More special reference will be made here to the proclivity of the present epoch among philosophers and theologians to parade science and religion side by side; talking of reconciling science and religion, as if they had ever been unreconciled. Scientists and theologians may have quarrelled, but never science and religion. At dinners they are toasted in the same breath, and calls made on clergymen to respond, who, for fear of giving offence, or lacking the fire and firmness of St. Paul, utter a vast amount of platitudes about the beauty of science and the truth of religion, trembling in their shoes all the time, fearing that science, falsely so called, may take away their professional calling, instead of uttering in voice of thunder, like the Boanerges of the gospel, that "the world by wisdom knew not God." And it never will. Our religion is made so plain by the light of faith that the wayfaring man, though a fool, cannot err therein.

No, gentlemen; I firmly believe that there is less connection between science and religion than there is between jurisprudence and astronomy, and the sooner this is understood the better it will be for both.

Religion is based upon revelation as given to us in a book, the contents of which are never changed, and of which there have been no revised or corrected editions since it was first given, except so far as man has interpolated; a book more or less perfectly understood by mankind, but clear and unequivocal in all essential points concerning the relation of man to his Creator; a book that affords practical directions, but no theory; a book of facts, and not of arguments; a book that has been damaged more by theologians than by all the pantheists and atheists that have ever lived and turned their invectives against it — and no one source of mischief on the part of theologians is greater than that of admitting the profound mystery of many parts of it, and almost in the next breath attempting some sort of explanation of these mysteries. The book is just what Richard Whately says it is, viz.: "Not the philosophy of the human mind, nor yet the philosophy of

the divine nature in itself, but (that which is properly *religion*) the *relation* and connection of the two beings — what God is to us, what he has done and will do for us, and what we are to be in regard to him."

Now science on her part has her records: they are the discovered truths in the relation that man bears to the animate and inanimate kingdoms around him, so far as they are made out by him from time to time; but as he has to proceed in his labors with imperfect instruments and often equally imperfect senses, he has to correct himself over and over again; and his observations and theories, especially the latter, make frequent shifts, though each time he supposes that the truth has been reached. I will exemplify this in a marked manner by an extract from a recent discourse by Prof. Ferdinand Cohn, delivered before the Silesian Society for Natural Culture. In speaking of Humboldt and his Cosmos (which he styles the "Divina Commedia" of Science, embracing the whole universe in its two spheres, heaven and earth) he says: "But we cannot conceal from ourselves that the Cosmos, *published twenty-five years ago*, is in many of its parts now antiquated. Any one who to-day would attempt to recast the Cosmos must proceed like the Italian architect who took the pillars and blocks of the broken temples of antiquity, added new ones, and rebuilt the whole after a new plan." And I would simply ask: When is this new structure to be torn down to form material for another? Surely the most enthusiastic admirer of the development of the last twenty-five years does not think that we have arrived at the end of all things!

I will take yet another example. For the last fifty years or more the unity of the human race has been a most prolific subject of investigation and discussion, until it was generally conceded that there must have been more than one origin for the different races. In fact, theologians had already entered on that mischievous work called reconciling science and religion, and saying that after all there was some little mistake in the biblical record on that subject, and, if the Author would only permit, it would be well to make a correction just there; but this could not be done, and there it stood — that all men were of one flesh. But science, restless, changeful, moved on; and to-day the unity of the human race is insisted on by nearly all the leading naturalists, who teach what Prof. De Quatrefages teaches, as uttered in a recent lecture

of his. He says: "In this examination of the physical man everything leads to the conclusion which we had already reached in our earlier lecture, and *we can repeat with redoubled certainty* that the differences among human groups are characters of race, and not of species. There exists only one human species, and consequently all men are brothers; all ought to be treated as such, whatever the origin, the blood, the color, the race;" and in conclusion he further says: "I shall not regret either my time or my pains, if I am able, in the *name of science, and that alone*, to render a little more clear and precise for you the great and sacred notion of the brotherhood of man."

One other example under this head, and I have done. The book of science teaches that the sun is the source of all light and heat; yet in that post-prophetic chapter of the book of our religion it is said that the creation of the first day was light, and not until afterward was the sun created; and this was again a stumbling-block to theologians, and many wished that Moses had been a little more particular. But science in its onward march, as it grouped together the matter floating in space to form in the beginning of time this earth (our circling globe), tells us that if we can imagine one to have been placed on our globe before it had consolidated, he would have seen vast seas of vapor floating around and far above it, shutting out the very light of heaven so that darkness brooded over the waters; that the first benign influence that smiled upon the earth was the gentle rays of light struggling through the dark mist; and the prophetic eye, either on the plain, in the valley, or on the highest mountain peak, would not behold whence it came, and might exclaim in sublime poetic ecstasy: "God said, Let there be light; and there was light." Not until ages, perhaps, after that did the bright orb of the sun reveal itself to the prophet as the source of this light.

So I say, let our book of religion stand as it is; if it be not of God it will come to naught; and let science search for truth, and if it mistake its results it is certain to correct them in time, for the causes of its perturbations are as surely discovered as Leverrier and Adams discovered those of Uranus.

Science and religion are both travelling towards the same great point — the Author of all truth — yet by two very different roads; and if they be induced every now and then to turn off their

routes to compare notes, they will very much retard each other's progress and waste much time in discussing the peculiar merits of their particular road, and get into a quarrel about them. The roads they travel are paved with certain principles and forces, but of very different natures.

Science treads on certain mathematical axioms and principles, recognizing matter and certain forces or modifications of an energy innate in matter, as heat, light, electricity, etc. Religion is guided by its axioms and principles, faith, love, and hope, and with these it is expected to work out its great end in the present and future of mankind. Science is nature revealed; religion is Nature's God revealed; and neither the one nor the other can be without its axioms, incapable of demonstration.

Some may mock at faith and say "Faith is bankrupt, and her accounts are under strict examination, to determine what assets remain to be distributed among the impoverished souls that are her creditors;" still it is an axiom made manifest to our consciousness, as much, if not even more so, than the axiom of a mathematical point being something without length, breadth or thickness, or a line as having length without breadth or thickness.

This faith is as much an energy of the immortal, as heat is one of the energies of matter. We know heat by its phenomena alone, and we know faith in the same way, its phenomena proving its existence as well to the child as to the man, to the learned and the unlearned. It led Socrates and Plato, even with their imperfect light, to the great God, the Creator of the heavens and the earth, and to a belief in the immortality of the soul.

What God is in his essence we know not, nor how it is that he can exist. A Being not made by himself nor any one else; without beginning of days or end of years: existing through infinite ages; filling immensity without being in any place; everywhere present without displacing a single one of his myriad creatures; pervading all things yet without motion; being all eye, all ear, all energy, and yet not interfering in the least with the thoughts and actions of man;—this has been well styled "the greatest mystery of the universe, enveloped at once in a flood of light and an abyss of darkness—inexplicable itself, explaining everything else, and after displacing every other difficulty, itself remaining in inapproachable, insurmountable, incomprehensible

grandeur, so that the Psalmist exclaims: 'Clouds and darkness are around about him; righteousness and judgment are the habitation of his throne.'"

This is the God whose existence reason cannot prove, while it cannot disprove, and whom the religionists and scientists are looking for: that they will one day see him as he is, is my firm belief, and, as I before stated, they will see him the sooner by keeping separate roads.

That many a scientist will be swallowed up in pantheism from want of patience is to be expected, and, I regret to acknowledge, will with Hartmann "maintain that creation is a cause, existence a misfortune, life a deepening disappointment, and that the extinction of personal consciousness is the only salvation;" but many more will enjoy the double felicity of arriving at the great end sustained both by science and by religion, and will agree with what Socrates wrote nearly two thousand years ago, without the revealed word of God to enlighten him—or to mystify him, as some would say. Listen to that philosopher of ancient days as he says: "This great God, who has formed the universe and supported the stupendous work whose every part is finished with the utmost goodness and harmony—he who preserves them perpetually in immortal vigor, and causes them to obey him with a never-failing punctuality and a rapidity not to be followed by the imagination—this God makes himself sufficiently visible by the endless wonders of which he is the author, but continues always invisible in himself. Let us not then refuse to believe even what we do not see, and let us supply the defects of our corporeal eyes by using those of the soul; but let us learn to render the just homage of respect and veneration to the divinity whose will it seems to be that we should have no other perception of him than by his benefits vouchsafed to us."

I cannot close this part of my subject without reverting to the tendency of certain men of science to make physical experiment the test of all truth; even prayer and divine providence influencing affairs in this world must become subjects for experiment; and if the results be not in accordance with the experiments, then suspicion is to be cast on faith. This has been truly explained as coming from the spirit of an age which strives to make natural science the all in all of wisdom, and begins with nature instead of beginning with God, and ends with burying man and

even God within physical conditions, and assigning to the supreme Spirit the impersonality that is usually ascribed to material nature; and all this in spite of the fact that profound philosophers and earnest devotees have believed in there being a consciousness subject to influence above their sense.

If we look at Nature as science has thus far penetrated into her mysteries, we discover in the innermost parts of the earth matter in a constantly restless state; in the ocean or the air we behold the ever moving, never resting; above are the sun and stars speeding on through boundless space, and they in their own masses are like huge boiling caldrons casting their vapors hundreds of thousands of miles into space. And so the toiler in science goes penetrating nearer and nearer, as he thinks, to the great cause of all things. In the same way he thinks he has discovered the cause of all motion upon this planet, both in the animate and inanimate, and he hastily concludes that the energy resident in the sun is fixed and invariable; yet while he reasons as if he had arrived at the prime cause, he admits that there is something yet unknown on which the sun depends as much as the earth does upon the sun.

While I admit most freely that the smallest event in the physical world is but the sequence of secondary causes (if I may use the expression) and effects, obedient to what appear to us fixed and invariable laws, yet it is illogical for any mind to assert that they cannot be altered by the operation of some energy that may reach beyond any cause yet discovered by the light of science.

While the *energy of the sun* travels in swift motion and in rapid undulations through the ethereal space that divides the earth from the sun, and in turn science by the spectroscope travels back from the earth to the sun over the same waves, and has revealed to her, in writing as it were, on the beautiful pages of the spectrum, the composition of that incandescent globe and the mighty power of its internal forces, so does the *energy of that great cause* that formed the sun reveal itself to the internal consciousness, reaching the eye of faith, by undulations more rapid than light; and as faith travels back, looking through its spectroscope (the revealed word of God), it beholds the constitution of that great cause as composed of infinite love and mercy, truth and justice.

As light has revealed the sun to us by penetrating an organ

specially formed for its impressions, *the physical eye*, so is God revealed by faith, *the soul's eye*. As well might we say that we are acquainted with all phenomena of the rays of the sun as to arrogate to ourselves the power of limiting the operations of faith.

In these things science is both vain and modest, logical and illogical; as, for example, here is what Dr. Cohn says, in a discourse of his previously referred to: "The deeper natural science penetrates from outward phenomena to universal laws, the more she lays aside her former fear to test the latest fundamental laws of being and becoming, of space and time, of life and spirit:" and in the next breath he says: "It is not to be hoped that during the next twenty-five years all the questions of science which are at present being agitated will be solved. As one veil after another is lifted *we find ourselves behind a still thicker one*, which conceals from our longing eyes the mysterious goddess of whom we are in search."

How Dr. Cohn expects to justify his first statement by his last assertion of the increasing thickness of the impenetrable veil is more than my logic can divine.

But in this matter of subjecting faith to physical test by what is now commonly called the "prayer-gauge," philosophers of the most advanced school differ very widely in their opinion; and that remarkable pantheist (or pessimist), Edward Von Hartmann (probably the most remarkable man of that school since the days of Spinosa, who believing only in nature, yet ranks with the old patriarchs in his idea of the power of faith, or something next akin to it) calls all mankind to "combine together in one grand act of self-abdication, and to resign the very faculty of will by a mighty concert, not of prayer, but of self-renunciation — by the help of such means as art and science may apply, and by such perfection of the magnetic telegraph as shall enable them all at once to will not to will any more, and so to bring all conscious personal life to an end by an absorption in the almighty and unconscious spirit." Not the most ascetic religious devotee could exhibit more unbounded confidence in the power of faith subverting not only the laws of nature, but nature herself, than is expressed in those views.

In fine then, gentlemen, let us stick to science—pure, unadulterated science—and leave to religion things which pertain to it; for

science and religion are like two mighty rivers flowing toward the same ocean, and before reaching it they will meet and mingle their pure streams, and flow together into that vast ocean of truth which encircles the throne of the great Author of all truth, whether pertaining to science or religion.

I will here, in defence of science, assert that there is a greater proportion of its votaries who revere and honor religion in its broadest sense, as understood by the Christian world, than in any other of the learned secular pursuits.

In this address I may be accused of more or less dogmatism: but I can assure the Association that whatever there may be of apparent dogmatism arises entirely from my reluctance to consume more time in making explanations and reasoning fully on the topics discussed. I have moreover departed from the usual character of discourses delivered by the retiring presidents of this association, and have not presented a topic that might have been of more interest to you, viz., some special scientific subject coming more immediately within the province of my research: for this departure I claim your indulgence, as well as for omitting all allusion to scientific progress during the past year.

But before concluding I cannot refrain from referring to one great event in the history of American science during the past year, as it will doubtless mark an epoch in the development of science in this country. I refer to the noble gift of a noble foreigner to encourage the poor but worthy student of pure science in this country.

It is needless for me to insist on the estimation in which Prof. John Tyndall is held amongst us. We know him to be a man whose heart is as large as his head, both contributing to the cause of science. We regard him as one of the ablest physicists of the time, and one of the most *level-headed* philosophers that England has ever produced — a man whose intellect is as symmetrical as the circle, with its every point equidistant from the centre.

We have been the recipients of former endowments from that land which, we thank God, is our mother country, from which we have drawn our language, our liberty, our laws, our literature, our science, and our energy, and without whose wealth our material development would not be what it is at the present day. Count Rumford, the founder of the Royal Society of London, in earlier years endowed a scientific chair in one of our larger uni-

versities, and Smithson transferred his fortune to our shores to promote the diffusion of science.

Now, while these are noble gifts, yet Count Rumford was giving to his own countrymen — for he was an American — and both his and Smithson's were posthumous gifts from men of large fortune.

But the one to which I now refer was from a man who ranks not with the wealthy, and he laid his offering upon the altar of science in this country with his own hands; and it has been both consecrated and blest by noble words from his own lips; all of which makes the gift a rich treasure to American science; and I think we can assure him that as the same Anglo Saxon blood flows in our veins as does in his (tempered, it is true, with the Celtic, Teutonic, Latin, etc.), he may expect much from the American student in pure science as the offspring of his gift and his example.

With this feeble tribute to our distinguished scientific collaborator I bid you adieu, and, returning to the association my most heartfelt thanks for the honor that has been conferred on me, surrender the mantle of my office to one most worthy to wear it — Prof. Lovering, of Cambridge.

ON SOME NEW FORMS OF AMERICAN BIRDS.

BY ROBERT RIDGWAY.

THE birds described in this article are chiefly geographical forms of well known species, which have not before been characterized. Though we consider them as geographical races, and not as distinct species, they are none the less entitled to separate consideration. According to the usual custom of ornithologists they would be ranked as distinct species; but the laws of geographical, or climatic, variation in external features, with which the public have been familiarized by the writings of Mr. Allen and other contemporary authors, are so evidently the cause of the differentiations noted, that we cannot but consider the forms here described as merely climatic races of species which have like representatives in other geographical provinces.

Included in the paper are some hitherto unpublished descriptions of races of birds by Prof. Baird.

1. *Catherpes Mexicanus*, var. *conspersus* RIDGWAY. Cañon Wren; White-throated Rock Wren.*

SP. CHAR. (No. 53.425 ♂, near Fort Churchill, Nevada, Dec. 7, 1867; R. RIDGWAY.) Above, brownish-ashy on the anterior, and bright cinnamon-rufous on the posterior half, the two colors shading insensibly together. The anterior, or grayish portion, thickly sprinkled with numerous small circular dots of white, each preceded by a smaller speck of dusky; a few of these dots on the rump. Wings with obsolete, ragged, narrow, *isolated* bars of dusky, these most sharply defined on the tertials. Tail clear rufous, crossed with about nine very narrow, thread-like, somewhat zigzag bars of black,—these about ·02 wide on the middle, and ·07 on the outer feather. Beneath, anterior third, pure silky-white, shading insensibly into soft ochraceous on the breast, this soon darkening into deep ferruginous, the color of all the posterior lower parts; the whole of this ferruginous surface with very obscure transverse spots of white, each preceded by a narrower dusky one. Length, 5·75; extent of wings, 7·50 (fresh); wing, 2·48; tail, 2·13; culmen, ·83; tarsus, ·56. Bill deep slate, paler and with lilaceous tinge at base of lower mandible; iris umber; tarsi and toes black (fresh colors).

HAB. Central region of North America, from boundary of United States northward to the parallel of 40°. Extends up Valley of Colorado. Western Nevada and Utah, resident; RIDGWAY. Colorado; AIKEN; ALLEN.

The above characters apply to all specimens of *Catherpes* from north of the Mexican boundary, as substantiated by a sufficient series in the collection. It is a remarkable fact that this northern race should be so much smaller than the Mexican one, especially in view of the fact that it is a resident bird in even the most northern parts of its ascertained habitat.

This race may be immediately distinguished from the Mexican form as follows:—

Culmen almost straight, the tip decurved, gonys straight. Above, blackish-brown; wings and back sparsely sprinkled with minute white specks; *no such markings on head or neck*. Bars on tail very broad, ·12 in width on outer feathers. Wing, 2·84; tail, 2·40; culmen, ·96; tarsus, ·75; middle toe, ·68; posterior, ·47; outer, ·52; inner, ·49 (52,791, Mazatlan, Mexico). *Hab.* Mexico . . . . . var. MEXICANUS.

Culmen and gonys both gently curved, the latter somewhat concave. Above, cinnamon-ashy, more reddish on rump and wings; head and neck above with numerous dots of white; very few of these on back and wings. Tail-bars very narrow and thread-like, ·07 in width on outer feathers. Wing, 2·48; tail, 2·12; culmen, ·83; tarsus, ·56; middle toe, ·52; posterior, ·35; outer, ·44; inner, ·36 (53,425 ♂, Fort Churchill, Nevada.) *Hab.* Middle Province of United States . . . . . var. CONSPERSUS.

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*Troglodytes Mexicanus Heermann, J. A. N. Sc., 2d ser., ii, 1853, 63.—Ib. P. R. R. Rep., x, 1859, 41.—Cassin, Illust. Birds Cal., i, 1854, 173, pl. xxx. Catherpes Mexicanus Baird, Birds N. Am., 1858, 356 (in part); Rev., p. 111 (in part).—Cooper, Orn. Cal., i, 1870, 66. Catherpes Mexicanus, *var.* conspersus Ridgway, Rep. U. S. Geol. Expl., 40th Par. (in press).

In var. *Mexicanus* the white of throat is more abruptly defined against the rufous of abdomen than in var. *conspersus*, in which the transition is very gradual. The latter has the secondaries rufous with narrow isolated bars of black; the former has them blackish, *indented* on lower webs with dark rufous. In *Mexicanus* the feet are very stout, and dark brown; in *conspersus* they are much weaker, and deep black.

All specimens from south of the United States boundary (including Giraud's type of *Certhia albifrons*) belong to the restricted *Mexicanus*.

HABITS.* The geographical distribution of this race of the white-throated wren, so far as known, is confined to the line of the United States and Mexican boundary, extending northward up the valley of the Colorado, as far as western Nevada, and along the Rocky Mountains into Colorado. The corresponding Mexican race reaches some distance southward, but has not yet been detected beyond the limits of Mexico. The habits of both races, however, are quite similar, as far as known.

Dr. Heermann first met with this wren in the spring of 1851, on the Cosumnes River. In the following year he procured three specimens on the Calaveras River. He describes it as an active, sprightly bird, having a loud and pleasing song that may be heard a great distance, and which it repeats at short intervals. When found, it was occupied with searching for insects, between and under the large bowlders of rock that, in some portions of the river, are thrown together in confused masses, as if by some terrific convulsion of nature.

Dr. Kennerly also met with this species in similar localities among the hills bordering upon the Big Sandy, where the rocks are also described as piled up thick and high. They were darting from rock to rock and creeping among the crevices with great activity, constantly repeating their peculiar and singular note. The great rapidity of their motions rendered it difficult to procure a specimen. He did not observe this bird anywhere else.

Their occurrence equally in such wild and desolate regions, and in the midst of crowded cities, indicates that the abundance of their food in either place, and not the absence or presence of man, determines this choice of residence. When first observed they

*By Dr. T. M. Brewer.

were supposed to nest exclusively in deep and inaccessible crevices of rocks, where they were not likely to be traced. Mr. H. E. Dresser afterwards met with its nest and eggs in western Texas, though he gives no description of either. He found this species rather common near San Antonio, where it remained to breed. One pair frequented a printing office at that place, an old half-ruined building, where their familiar habits made them great favorites with the workmen, who informed him that the previous spring they had built a nest and reared their young in an old wall close by, and that they became very tame. At Dr. Heermann's rancho, on the Medina, he procured the eggs of this bird, as well as those of the Carolina and Bewick's wrens (*Thryothorus Ludoviciana* and *T. Bewickii*), by nailing up cigar-boxes with holes cut in front, wherever these birds were likely to build.

Mr. Sumichrast describes its nest* as very skilfully wrought with spiders' webs, and built in the crevices of old walls, or in the interstices between the tiles under the roofs of the houses. A nest with four eggs, supposed to be those of this species, was obtained in western Texas by Mr. J. H. Clark; it was cup-shaped, not large, and with only a slight depression. The eggs, four in number, were unusually oblong and pointed for eggs of this family, and measured ·80 by ·60 of an inch, with a crystalline-white ground, profusely covered with numerous and large blotches of a reddish or cinnamon brown.

So far as the observations of Mr. Ridgway enabled him to notice this bird, he found it much less common than the *Salpinctes obsoletes*, and inhabiting only the most secluded and rocky recesses of the mountains. Its common note of alarm is described as a peculiarly ringing *dink*. It has a remarkably odd and indescribably singular chant, utterly unlike anything else Mr. Ridgway ever heard. This consists of a series of detached whistles, beginning in a high fine key, every note clear, smooth, and of equal length, each in succession being a degree lower than the preceding one, and only ending when the bottom of the scale is reached. The tone is soft, rich and silvery, resembling somewhat the whistling of the cardinal grosbeak.

It was often seen to fly nearly perpendicularly up the face of a

*This remark applies to the Mexican race.

rocky wall, and was also noticed to cling to the roof of a cave with all the facility of a true creeper.

2. *Helminthophaga celata*, var. *lutescens* RIDGWAY. Pacific Orange-crowned Warbler.*

SP. CHAR. *Male.* Upper surface continuous bright olive-green. Whole lower parts, including superciliary stripe and eyelids, bright yellow, almost gamboge; abdomen somewhat whitish. Inner webs of tail feathers just perceptibly edged with white. Whole crown bright orange-rufous, scarcely concealed. Wing, 2·40; tail, 1·90; bill, ·40; tarsus, ·67; middle toe, ·45. Wing-formula, 2, 3, 1, 4. *Female.* Similar, but orange of crown almost obsolete. Wing, 2·30; tail, 1·90. *Young of the year.* Similar to adult, but with a brownish tinge above; middle and secondary coverts tipped with dull fulvous, furry, inconspicuous bands. No trace of orange on the crown.

HAB. Pacific Province of North America, from Alaska to Cape St. Lucas. Straggling eastward to about the 116th meridian. Not found in Mexico?

The differences between the Pacific coast specimens of *H. celata* and those from the interior regions—first pointed out in the "Review of American Birds"—are very readily appreciable upon a comparison of specimens. The present bird is a coast variety, entirely replacing the true *celata* (var. *celata*) in the region above indicated.

3. *Dendroica Vieillotii*, var. *Bryanti* RIDGWAY. Bryant's Golden Warbler.

SP. CHAR. Similar to D. Vieillotii,† but with the rufous of the head and neck abruptly defined posteriorly, instead of passing backward on the jugulum; the rufous streaks on the breast very narrow, instead of broad and blended; and the outer webs of wing-coverts greenish, nearly concolor with the back, instead of nearly clear yellow, in marked contrast. Wing, 2·70; tail, 2·25; culmen, ·31; tarsus, ·72 (♂).

HAB. Mexico, from Honduras (Dr. BRYANT) and Yucatan (Dr. SCHOTT) to Mazatlan (Col. GRAYSON).

4. *Dendroica Dominica*, var. *albilora* BAIRD. White-browed Warbler.‡

SP. CHAR. Similar to D. Dominica,‡ but with smaller bill, longer wing and tail, and white, instead of yellow, supraloral line. Wing, 2·70; tail, 2·20; culmen, ·35; tarsus, ·60.

HAB. Mexico, south to Guatemala, west to Colima, and east to Yucatan and Honduras. In summer, the Mississippi valley of the U. S., north to Cleveland, Ohio; breeding from southern Illinois southward.

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*Helminthophaga celata Cooper and Suckley, P. R. R., xii, ii, 1859, 178.—Lord, Pr. R. Art. Inst. Woolwich, iv, 1864, 115.—Baird, Rev. Am. Birds, i, 1865, 175 (in part).—Cooper, Orn. Cal., i, 1870, 83. H. celata, *var.* lutescens Ridgway, Report U. S. Geol. Expl. 40th Par. (in press).

†Dendroica Vieillottii Baird, Review, p. 203. (Cassin, P. A. N. S., 1860, 192, Panama.)

‡Dendroica Dominica Baird, Rev. Am. B., 1865, p. 209 (in part).

In the "Review" (p. 209) several variations in this species are noted; but at that time there was not a sufficient number of specimens to warrant our coming to a conclusion as to their value. Now, however, we have better materials before us, and upon the examination of about thirty specimens, including two series of nearly equal numbers,—one from the Atlantic states and the West Indies, the other from the Mississippi region and middle America—find that there are two appreciably different races, to be distinguished from each other by points of constant difference. All birds of the first series have the bill longer than any of the latter, the difference in a majority of the specimens being very considerable; they also have the superciliary stripe bright yellow anteriorly, while among the latter there is never more than a trace of yellow over the lores, and even this minimum amount is discernible only in one or two individuals. The West Indian form is, of course, the true *Dominica*, and to be distinguished as var. *Dominica;* as none of the synonymes of this species were founded upon the Mexican one, however, it will be necessary to propose a new name; accordingly, the term var. *albilora* is selected as being most descriptive of its peculiar features.

The following synopsis, taken from typical specimens, shows the differences between these two races:—

(No. 3.322, ♂, Liberty county, Georgia.) Bill (from nostril), ·45; tarsus, ·60; wing, 2·60; tail, 2·00. Superciliary stripe, anterior to eye, wholly bright yellow; yellow of chin and maxillæ extending to the bill. *Hab.* In summer, Atlantic States of United States, north to Washington. In winter, and possibly all the year, in Cuba, Santo Domingo and Jamaica . . . var. DOMINICA.

(No. 61,136, ♂, Belize, Honduras.) Bill (from nostril), ·35; tarsus, ·60; wing, 2·70; tail, 2·20. Superciliary stripe wholly white; yellow of chin and maxillæ bordered narrowly next the bill with white. *Hab.* In summer, the Mississippi region of United States, north to Lake Erie; common in south Illinois. In winter, and possibly all the year, in Mexico, south to Guatemala, Yucatan on the Atlantic, and Colima on the Pacific side . . . . . var. ALBILORA.

In the lower Wabash valley this form of the yellow-throated warbler is rather common during summer, and inhabits chiefly the margins of swamps in the bottom-lands, though in spring and fall it makes occasional visits, with other species, to the orchards or even the door-yards within the towns. In its manners it resembles the black and white creeper (*Mniotilta varia*) more than any other species, creeping, not only along the branches of trees, but over the cornice and eaves of buildings, with all the facility of a nuthatch.

5. *Dendroica Graciæ*, var. *decora* Ridgway. Honduras Warbler.

Sp. Char. Similar to D. Graciæ,* but wing and tail much shorter, and general form less slender. The superciliary stripe wholly yellow and scarcely passing the eye, instead of white for from an eighth to nearly a quarter of an inch behind the eye; yellow of throat and jugulum extending over the breast, instead of only reaching to its anterior border; lore deep black, instead of dusky grayish; streaks on the back and crown narrower, and those on the upper tail-coverts broader. Above fine ash, the crown, back and upper tail coverts with shaft-streaks of black; supraloral stripe reaching back to posterior angle of the eye; throat, jugulum and breast, gamboge yellow; rest of lower parts white; wing with two white bands, and inner webs of tail feathers with white patches. Wing, 2·20; tail, 1·95; culmen, ·30; tarsus, ·60.

Hab. Belize, Honduras.

The differences between the three races of *D. Graciæ* may be expressed as follows:—

Common Characters. Auriculars, neck, crown and upper parts generally, ashy; a supraloral stripe; crescent on lower eyelid, and the anterior lower parts gamboge yellow; crissum white.

a. Back and sides streaked with black; abdomen white.

Yellow of throat terminating abruptly at the jugulum; supraloral stripe reaching ·20 of an inch back of the eye, this portion of it white; dorsal streaks broad. Wing, 2·60; tail, 2·20. *Hab.* Arizona (Fort Whipple) . . . . . var. GRACIÆ.*

Yellow of throat covering whole jugulum and not ending abruptly; supraloral stripe scarcely passing eye and wholly yellow; dorsal streaks narrow. Wing, 2·20; tail, 1·95. *Hab.* Honduras (Belize) . . . . . var. DECORA.

b. Back and sides not streaked with black; abdomen yellow.

Yellow of throat extending back to crissum; supraloral stripe as in var. decora; dorsal streaks wanting. *Hab.* Porto Rico, W. I. . . . . var. ADELAIDÆ.†

6. *Myiodioctes pusillus*, var. *pileolata* (Pallas).‡

Sp. Char. Similar to M. pusillus, but much richer yellow, scarcely tinged with olive laterally, and deepened into an almost orange shade on the front and chin. Above much brighter and more yellowish olive-green. The black pileum with a brighter steel-blue gloss. Bill much narrower, light brown above, instead of nearly black. Measures (4,222 ♂, San Francisco, Cal.), wing, 2·15; tail, 2·00.

Hab. Pacific coast region of North America, from Kodiak (Alaska); south through Western Mexico (and Lower California) to Costa Rica.

This is an appreciably different race from that inhabiting the eastern division of the continent; the differences, tested by a large series of specimens, being very constant.

A Costa Rican specimen before us is almost exactly like specimens from California.

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*"Dendroica Graciæ Coues," Baird, Review Am. B., 1865, 210.

†Dendroica Adelaidæ Baird, Review, p. 212.

‡Motacilla pileolata Pallas, Zoög. Rosso Asiat., i, 1831, 497 (Russian America). Myiodioctes pusillus, *var.* pileolata Ridgway, Report U. S. Geol. Expl. 40th Par. (in press). Myiodioctes pusillus Auct. (all citations from Pacific coast of North and Middle America).—Lord, Pr. Art. Inst. Woolw., iv, 1864, 115 (Br. Col.).—Dall & Bannister (Alaska).—Cooper, Orn. Cal., i, 1870, 101.

7. *Collurio Ludovicianus*, var. *robustus* BAIRD. White-winged Shrike.*

SP. CHAR. Similar to C. Ludovicianus, but bill much stouter; differs from excubitoroides in darker colors, and absence of hoary border to the forehead; from both in having the four middle tail feathers entirely black to the roots, and the bases of the remaining feathers merely grayish, and in the great amount of white on the inner webs of the secondaries, in the latter respects resembling C. excubitor, of Europe. Length, 8·75; wing, 4·20; tail, 4·40; its graduation, 1·00; culmen, 1·00; depth of bill, ·39; tarsus, 1·20; middle toe, ·61. *Hab.* California?

The above description is taken from a specimen in the collection of the Philadelphia Academy, labelled as having been collected in California by Dr. Gambel, and is very decidedly different from any of the recognized North American species. Of nearly the size of *C. excubitoroides* and *Ludovicianus*, it has a bill even more powerful than that of C. *borealis*. In its unwaved under parts and uniform color of the entire upper surface, except scapulars, it differs from *borealis* and *excubitoroides*, and resembles *Ludovicianus*. In the extension of white over the inner webs of the secondaries it closely resembles *C. excubitor*. The great restriction of white at the base of the tail—the four central feathers being entirely black, and the bases of the others grayish-ashy—is quite peculiar to this form.

The specimen in the Philadelphia Academy we originally referred to the *L. elegans* of Swainson, alleged to have come from the fur countries; as, although some appreciable differences presented themselves, especially in the coloration of the tail, these were considered as resulting from an imperfect description. Messrs. Sharpe and Dresser, however, as here quoted, show that Swainson's type really belongs to *L. lahtora*, an Old World species. We, therefore, find it expedient to give a new name to the variety, having no reason to discredit the alleged locality of the specimen.

Synopsis of the species (including 8, 9, 10 and 11 of this article) of the

GENUS CERTHIOLA SUNDEVALL.†

By SPENCER F. BAIRD.

GEN. CHAR. Bill nearly as long as the head; as high as broad at base, elongated, conical, very acute, and gently decurved from base to tip. Culmen uniformly convex;

*?? Lanius elegans Sw. F. B. A. ii, 1831, 122.—Nuttall, Man. i, 1840, 287.—Cassin, Pr. A. N. Sc., 1857, 213.—Baird, Birds N. Am., 1858, 327. Collyrio elegans Baird, Birds N. Am., 1858, 328. Collurio elegans, Baird, Rev. Am. B., 1864, 444.—Cooper, Orn. Cal., 1870, 140. (According to Dresser & Sharpe, P. Z. S., 1870, 595, who have examined the type, the L. elegans of Swainson is the same as L. lahtora Sykes, of Siberia.) HAB., California?

† Certhiola Sundevall. Vet. Akad. Handl. Stockholm, 1835, 99. (Type, Certhia flaveola Linn.).

gonys concave. No bristles at base of bill. Tail rounded, rather shorter than the wings. Tarsi longer than the middle toe. Iris brown? Nest pensile and arched. Eggs with yellowish ground dotted thickly with rufous spots.

This genus is one of those especially characterizing the West Indies, almost every island as far as known having its peculiar species, differing, it is true, in very slight characters, but always constant to the normal type. Cuba alone has so far furnished no representative of this genus, its place being supplied apparently by *Cœreba cyanea*, distributed besides throughout the continental tropical regions. The specimens from St. Thomas I cannot distinguish from those of Porto Rico, but this is, so far as the series before me indicates, the only case where one species occurs on two islands. All the West Indian species, nine or ten in number, agree in having the whole upper part nearly uniformly dusky or blackish; the head and back being concolored, while of the three or four South American, all but one (*C. luteola*) have the back more olivaceous, the head much darker. Again, the West Indian species, with a single exception (*C. bananivora*), have both webs of lateral tail feathers broadly and about equally tipped with white; while in all the South American this white is more restricted on the inner web, and on the outer reduced to a narrow border. *C. Caboti* from Cozumel, near eastern coast of Yucatan, exhibits the continental impress in possessing the character last mentioned.

In all the species from the Greater Antilles and the portion of continental America west and directly south of this group, there is a distinct external white patch at base of quills; while this disappears in the species of the Lesser Antilles and eastern South America, or is only faintly traceable. Again, in the species of the Lesser Antilles, with the disappearance of the white wing-patch, the greater and middle wing-coverts show a faint edging of lighter, by which, as well as by the darker back, they are distinguished from their South American allies.

The shape of the white patch at base of the quills on the outer web furnishes, in combination with the color of the throat, excellent and permanent specific characters. This in the Jamaican, Haytien and Bahaman forms is elongated, extending gradually and uniformly behind to the outer edge of the quill, while in those of Porto Rico, St. Thomas, Cozumel, and the South American species, where it exists, the posterior outline is nearly transverse, and only running out a little along the outer web.

As a general rule South American species have shorter tails than the West Indian.

It is a nice question what are really species in this genus, and what merely races or varieties; but it would probably be not far from correct to assume that the various forms described are simply modifications of one primitive species, produced by geographical distribution and external physical conditions. In the following diagnosis I shall treat all the varieties as occupying the same rank, without attempting any discrimination. Although but one of these belongs to the United States, and that as a straggler from the Bahamas, I give the table of the whole, to show the interesting relationship between them.

COMMON CHARACTERS. Above dusky-olive or blackish; the rump olivaceous or yellowish; the head and cheeks always black, and sometimes darker than back. Chin and throat ashy or black. Rest of under part yellow, duller behind. A broad white stripe from bill above eye to nape. A white patch at base of primaries; generally visible externally, sometimes concealed. Lateral tail feathers tipped with white. Bill black; legs dusky.

A. Head uniform in color with rest of upper parts; dark sooty-brown or blackish. Both webs of outer tail feather tipped with white (except in luteola). All West Indian except luteola, which, however, occurs in Tobago and Trinidad, and generally belongs to the shores of the Caribbean Sea.

1. A distinct and conspicuous external white patch at base of primaries. Wing-coverts not margined with paler.

a. Throat uniformly but decided dark ash-color, varying in shade, never entirely black, however, nor ashy-white.

Throat very dark ash, not contrasting or appreciably different from blackish of cheeks.

Wing-spot elongated; the white running out gradually and obliquely behind to the outer edge of the primary, reaching shaft of outer primary. Yellow of breast decidedly ochraceous. Rump as bright yellow as the belly. *Hab.* Jamaica . . . . . FLAVEOLA. *

White patch of wing more quadrate on each quill; transverse; not tapering off gradually and uniformly behind; not reaching the shaft on outer primary. Breast without ochraceous; rump olivaceous-yellow; the color different from that of belly. *Hab.* Santa Cruz . . . . . NEWTONI. †

b. Chin and throat lighter ash (but not at all whitish); in decided and appreciable contrast with blackish of cheeks. Jugulum yellow, like under parts generally.

Lateral tail feather broadly tipped with white on both webs. Rump olivaceous-yellow.

Wing-spot on each primary nearly quadrate, as in Newtoni. *Hab.* Porto Rico and St. Thomas . . PORTORICENSIS. ‡

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*Certhia flaveola Linn. Syst. Nat., ed. 10. 1758, 119.

†C. flaveola A. & E. Newton, Ibis, 1859, 67. *Hab.* St. Croix. C. Newtoni Baird. (8.)

‡C. flaveola, *var.* Portoricensis Bryant, Pr. Bost. Soc. N. H., Jan., 1866. *Hab.* Porto Rico.

Lateral tail feather with inner web only broadly tipped with white. Rump bright yellow like belly. Bill very small.

White of wing as in flaveola, but less extended, and margining edge only of outer primary. *Hab.* Hayti and St. Domingo . . . . . BANANIVORA.*

White of wing as in Newtoni. Size much larger; darker above. *Hab.* Tobago, Trinidad, and north shore of South America . . . . . LUTEOLA.†

c. Chin, throat and jugulum white, with a tinge of ashy. Yellow of under parts much restricted.

Depth of bill less than half distance from nostril to tip. Superciliary stripe reaching to nape. Yellow of under part restricted to a triangular patch on breast. White spot on wing large, tapering off gradually on each primary, as in flaveola; on the outer reaching shaft. Both webs of outer tail feather about equally tipped. *Hab.* Bahamas and Florida Keys . . BAHAMENSIS.‡

Depth of bill fully half distance from nostril to tip. Superciliary stripe reaching the occiput only. Yellow of under parts more extended. White spot on wing restricted; more quadrate, as in Newtoni; edge only of outer primary involved. Outer web of outer tail feather scarcely tipped. *Hab.* Cozumel Island, Yucatan . . . . . CABOTI.§

2. No external white patch at base of primary quills. Wing-coverts obscurely margined with paler. Both webs of outer tail feathers tipped about equally with white. Rump olivaceous; this color of but slight extent.

a. Throat black; continuous with black of cheeks; or else very dark plumbeous, scarcely distinguishable from the cheeks.

Median line of throat white, the sides black like the cheeks; chin alone black. Superciliary stripes not confluent anteriorly. *Hab.* Martinique . . . . . MARTINICANA.‖

Whole throat blackish. No white frontal band?

Wing, 2·50 inches. Belly ochraceous. *Hab.* Dominica Island, West Indies . . . . . DOMINICANA.¶

Wing, 2·20 inches. Belly more yellow. *Hab.* Barbadoes . . . . . BARBADENSIS.**

Whole throat very dark plumbeous. A whitish frontal broad band connecting the superciliary stripes which extend in front of the eye. *Hab.* Antigua, West Indies . . . . FRONTALIS.††

A grayish frontal band; superciliary stripes narrow; not extending in front of eye. Trace of white patch at base of primaries . . . . . BARTHOLEMICA.‡‡

B. Head blackish, in distinct contrast to the more olivaceous back. Outer tail feather with outer web scarcely tipped with white. Wing-coverts not margined with paler. Throat light ash, in distinct contrast to black of cheek.

1. A distinct external white wing-patch at base of primaries.

Rump olive-green. *Hab.* Mexico and Central America, but hardly reaching line of Panama R. R. . . MEXICANA.§§

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*Motacilla bananivora Gmelin, Syst. Nat., i, 1788, 951. (Bananiste Buffon, St. Domingo.)

†Certhiola luteola Cab., M. H., 1851, 96. C. major Cab.; C. minor Bon.

‡Certhiola Bahamensis Reich., Handb., i, 1853, 253. C. flaveola Baird, B. N. A.; C. Bairdi Cab.

§C. Caboti Baird, MSS. (9.)

‖C. Martinicana Reich. Hand., i, 1853, 252. C. albigula Bon.

¶C. Dominicana Taylor, Ibis, 1864, 167.

**C. Barbadensis Baird, MSS. (10.)

††C. frontalis Baird, MSS. (11.)

‡‡C. Bartholemica Sundevall & Sparrmann, Vetensk. Akad. Förhandl., 1869, 622.

§§C. Mexicana Sclater, P. Z. S., 1856, 286.

Rump olive-yellow. *Hab.* Panama R. R.; south along Andes to Peru . . . . . PERUVIANA.*

a. No external white wing patch.

Rump olive-green. *Hab.* Brazil and Guiana . CHLOROPYGA.†

The preceding table is based upon a critical examination of many hundred specimens belonging to the Smithsonian Institution.

Synopsis of the species of

JUNCO Sclater.

By Robt. Ridgway.

Common Characters. Prevailing color plumbeous, or grayish, the abdomen crissum and lateral tail feathers white (*J. hyemalis*).

A. Both mandibles light flesh color. Color of the jugulum, deep ash or plumbeous-black, abruptly defined against the pure white of the abdomen.

a. Dark color of the jugulum with its posterior outline convex; sides pinkish.

1. Back and wings more or less tinged with dark rusty. *Hab.* Pacific province of North America, from Sitka southward; straggling eastward in autumn and winter to the Rocky Mountains, and even to Kansas . . . . . var. OREGONUS.‡

b. Dark color of the jugulum with its posterior outline concave; sides ashy.

§Back and wings without any rusty tinge.

2. Wing without any white; three outer tail feathers, only, marked with white. Culmen, ·40; depth of bill, ·25; wing, 3·10; tail, 2·80. *Hab.* Eastern province of North America; straggling, in autumn and winter, into the Rocky Mountains (Arizona, Coues; Utah, Henshaw; Colorado, Aiken) . . . . . var. HYEMALIS.§

3. Wing with two white bands across ends of coverts and sometimes a third across ends of secondaries; four or five outer tail feathers marked with white; ash much lighter. Culmen, ·50; depth of bill, ·30; wing, 3·40; tail, 3·20. *Hab.* Alpine regions of Colorado Mountains (El Paso Co., Aiken) . . . . . var. AIKENI.‖

§1. Back (interscapulars only) rufous; scapulars and wings uniform ashy. *Hab.* Central Rocky Mountains of the U. S. . . var. CANICEPS.¶

B. Upper mandible black, the lower yellow. Ash of the jugulum fading gradually into the grayish white of the abdomen.

§ Whole back, scapulars, wing-coverts and tertials strongly washed with rufous.

5. Throat and jugulum pale ash; back bright rufous. Wing, 3·10; tail, 3·00; culmen, ·34; depth of bill, ·25; tarsus, ·80. *Hab.* Tablelands of Mexico . . . . . var. CINEREUS.**

6. Throat and jugulum deep ash; back dull, or olivaceous, rufous. Wing, 3·15; tail, 3·10; culmen, ·44; depth of bill, ·34; tarsus, ·90. *Hab.* High mountains of Guatemala . . . . var. ALTICOLA.††

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*C. Peruviana Cab., Journ., 1865, 413? Perhaps different.

†C. chloropyga Cab., M. H., 1851, 97. C. Brasiliensis Bp.

‡ Birds N. Am., 1858, 466. (Fringilla Oregona Townsend, J. A. N. S., 1837, 188.)

§ Birds N. Am., 1858, 468. (Fringilla hyemalis Linn., S. N. i., 1758, 183.)

‖ Junco hyemalis, *var.* Aikeni Ridgway, MSS.

¶ Birds N. Am., 1858, 468. (Struthus caniceps Woodh., P. A. N. S., 1852, 202).

** Birds N. Am., 1858, 465. (Fringilla cinerea Swains., Syn. Mex. B., i, 1827, 435).

†† Junco alticola Salvin, P. Z. S., May, 1863, p. 189.

The six forms diagnosed above appear to be well characterized by the distinctive features pointed out; and each one is so characteristic of the region which it inhabits that at least ninety per cent. of the specimens obtained during the breeding season in any locality will be typical representatives of one or the other of these races. Unless, however, we admit the theory of hybridization, to account for intermediate specimens, and acknowledge it especially in this case, it is impossible to consider that any two of these forms are distinct specifically, for they are connected by an uninterrupted series between the most extreme forms—*hyemalis* and *alticola*—without a break in the gradual progression from the one to the other. Thus, from Sun River, Dakota; Ft. Whipple, Arizona; Ft. Bridger, Wyoming, and the McKenzie River district, are specimens with the pinkish sides of *Oregonus* and plumbeous back of *hyemalis;* or else with black head or rusty back and wings, of the former, with ashy sides of the latter; or with the characters of the two mixed in various degrees. In the same manner other specimens, from Ft. Bridger, Ft. Whipple, Ft. Burgwyn, New Mexico, Colorado, and the Yellowstone region, have the bright rufous interscapulars, ashy head, and black lores of *caniceps* with the pinkish sides and rounded outline to the ash of breast as in *Oregonus;* or else they have the rufous spread over the wings as in *Oregonus*, and other characters as distinguishing *caniceps;* other specimens are intermediate between the two in various ways. This form was characterized by Professor Baird as *Junco annectens* (Birds Cal., i, 1870, app., p. 564). Among the southern Rocky Mountains, and in northern Mexico, specimens are found which combine perfectly the characters of *caniceps* and *cinereus*. These have the black and yellow bill and pale ash throat of the latter, and the rufous of the back strictly confined to the interscapulars as in the former. This form is the *J. dorsalis* of Henry (Proc. Philad. Acad., 1858, 117. Baird, B. N. Am., 1858, 467).

In the effect of climate upon size, altitude appears to have far more potency in this group than latitude; thus in tracing these forms southward, there is no noticeable decrease in dimensions, but on the contrary, the most southern form (*alticola*) is larger than the most northern one (*hyemalis*). The alpine forms, however, *alticola* and *Aikeni*, are considerably larger than those which breed at lower elevations. The climatic color-variation in this

group is rather perplexing, though we can unravel some few clews to the laws. In *Oregonus* of the Pacific coast we find the castaneous or fuliginous plumage characteristic of that region; *caniceps* of the middle region is paler than *Oregonus* and *hyemalis*, as would be expected; in *Aikeni* we readily detect the albinescent plumage of a very cold, alpine region. If we cannot find the same tiling in *alticola*, of the alpine summits of Guatemala, and see that instead it is *darker* than the race inhabiting the lower table-lands (*cinereus*), we must look for an explanation. This may, perhaps, be found, in the supposition that the higher summits of Guatemala have a climate sufficiently cool and bracing to invigorate the bird generally, and thus make it larger and stronger, while at the same time the winter temperature is not rigorous enough to produce any blanching effect upon the plumage, while local conditions — perhaps denser forests or thickets — give it a deeper color than *cinereus* of the more open table-lands.

12. *Junco hyemalis*, var. *Aikeni* RIDGWAY. White-winged Snowbird.

SP. CHAR. Generally similar to J. hyemalis, but considerably larger, with more robust bill; two white bands on the wing, and three or four, instead of two or three, outer tail feathers entirely white. No. 61,302 ♂, El Paso Co., Colorado, Dec. 11, 1871, C. E. Aiken. Head, neck, jugulum, and entire upper parts clear ash with a bluish tinge; the lores, quills, and tail feathers darker; middle and secondary wing-coverts rather broadly tipped with white, forming two conspicuous bands. Lower part of the breast, abdomen, and crissum pure white, the anterior outline against the ash of the jugulum convex; sides tinged with ash. Three lateral tail feathers entirely white, the third, however, with a narrow streak of dusky on the terminal third of the outer web; the next feather mostly plumbeous, with the basal fourth of the outer web, and the terminal of the inner, along the shaft, white. Wing, 3·40; tail, 3·20; culmen, ·50; depth of bill at base, ·30; tarsus, ·80. HAB. El Paso county, Colorado.

At first sight, this bird appears to be a very distinct species, being larger than any other North American form, and possessing in the white bands on the wing characters entirely peculiar. Its large size, however, we can attribute to its alpine habitat, agreeing in this respect, as compared with *J. hyemalis*, with the *J. alticola*, of Guatemala, which we can only consider an alpine, or somewhat local, form of *J. cinereus*. That the white bands on the wing do not constitute a character sufficiently important to be considered of specific value is suggested by the fact that in *J. oregonus*, and occasionally in *J. hyemalis*, there is sometimes quite a distinct tendency to these bands, in the form of obscure white tips to the coverts.

A series of six specimens (four males and two females), sent for examination, is said by Mr. Aiken to illustrate fully the limit of variation in a series of some twenty or thirty skins. No. 1071 (Aiken's collection) is an extreme example. This has the wing bands ·20 of an inch wide, while the secondaries are broadly tipped with white, forming a third band (somewhat as in *Cyanura cristata*) when the wing is closed; the primaries are conspicuously skirted with white for the terminal half, and the three outer tail feathers on each side are entirely white; only the middle pair is without any white on the webs, and these have the shafts of this color. The other extreme is illustrated in No. 1068, which has the bands on the coverts hardly indicated, while there are none on the inner webs of the secondaries nor outer webs of the primaries. There is nearly as much white on the tail, however, as in No. 1071. Mr. Aiken says that "the majority of the females are without the wing-bands, and they are occasionally wanting in the male."

The largest specimen in the series measures as follows: "length, 7·15; extent, 11·50;" wing, 3·60; tail, 3·50; culmen, ·51; depth of bill, ·27; tarsus, ·85. Few males are smaller and the variation in size is very slight.

Habits. But little is known as to the habits of this variety; probably they do not differ from those of its congeners. It was met with by Mr. C. E. Aiken, near Fountain, El Paso county, in Colorado Territory, in the winter of 1871–72. They were rare in the early winter, became rather common during the latter part of February and the first of March, and had all disappeared by the first of April. During winter only males were seen, but in the spring, the females were most numerous. They were usually seen singly, or in companies of two or three, and not like the others, in larger flocks.

13. *Peucæa æstivalis*, var. *Arizonæ* Ridgway. Arizona Sparrow.*

Sp. Char. (6,327 ♂, Los Nogales, northern Sonora, June; C. B. Kennerly). Similar to P. æstivalis, but paler; wings and tail longer. Above light chestnut, all the feathers margined and tipped with bluish-gray, but the reddish prevailing. Interscapular and crown feathers with a narrow streak of black, those on crown indistinct. Beneath dull white, tinged with ashy-ochraceous across the breast and along the sides; crissum pale ochraceous. An obsolete light superciliary, and narrow dusky maxillary stripe. Bend of wing yellow; lesser coverts tinged with greenish-yellow. Length 6 inches; wing, 2·65; tail, 3·00; bill, ·32 from nostril, ·25 deep at base; tarsus, ·80; middle toe, ·63. Hab. Los Nogales, Sonora, and southern Arizona.

*Peucæa Cassini Baird, Birds N. Am., 1858, 486. (Los Nogales specimen.)

This race has a considerable resemblance to var. *æstivalis*, but differs in some appreciable points. The brown of the upper parts is paler, and the ashy edging to the feathers appears rather less extensive. The dark brown blotches on the back are of greater extent, the black streaks on the back confined to a mere streak along the shaft. There is less of an olive tinge across the breast.

The proportions of the present race differ more from those of *æstivalis* than do the colors, the bill being more slender, and the wings and tail considerably longer.

The resemblance to *P. Botterii* (=*æstivalis*, var. *Botterii*) of Sclater, from middle Mexico (Orizaba, Colima, etc.), is very close; the difference being greater in the proportions than in the colors, the latter having a shorter wing and tail, with thicker bill, as in var. *æstivalis*. In *Botterii* there is rather a predominance of the black over the rufous in the streaks above.

In the "Birds of North America," the specimen described above was referred to *P. Cassini*, those specimens upon which the latter species was founded being considered as in quite immature plumage. A more recent examination of additional material, however, has compelled us to regard them as representing a perfectly distinct species. In consequence of the similarity of the specimen in question to *æstivalis*, as noted in the article referred to above, the general acceptation of the name *Cassini*, has been that of a term designating a variety of the common species; but we find it necessary to retain under the head of "*Cassini*" only the typical specimens from the Rio Grande region, and refer the supposed aberrant specimen to *æstivalis*. In this Los Nogales specimen we find existing such differences in proportions and colors as are sufficient to warrant our bestowing upon it a new name, and establishing it as the middle province race of *æstivalis*, in this way connecting the south Atlantic and Mexican races (var. *æstivalis* and var. *Botterii*) by a more similar form than the *P. Cassini*, which must be set apart as an independent form,—in all probability a good species. Several facts are favorable to this view. First, we have, of the *P. Cassini*, specimens which are beyond question in perfect adult plumage, and others which are undoubtedly immature; they differ from each other only in such respects as would be expected, and agree substantially in other characters, by which they are distinguished from the different plumages of *æstivalis*. Secondly, the region to be filled by a peculiar race of *æstivalis* is represented by

the var. *Arizonæ*, which is undoubtedly referable to that species; thus we have in one province these two different forms, which therefore are probably distinct.

The *P. Cassini* is hardly less distinct from the races of *æstivalis* than is *ruficeps;* and we should be as willing to consider the latter as a race of *æstivalis*, as to take the same view in regard to *Cassini*.

Synopsis of the genus

CARDINALIS Bonap.

By Robert Ridgway.

Common Characters. *Male.* Bright vermilion-red, more dusky purplish on upper surface; feathers adjoining base of bill black for greater or less extent. *Female.* Above olivaceous, the wings, tail and crest reddish; beneath olivaceous-whitish, slightly tinged on jugulum with red.

C. Virginianus. Culmen nearly straight; commissure with a slight lobe; upper mandible as deep as the lower, perfectly smooth. Bill red. Black patch covering whole throat, its posterior outline convex. *Female.* Lining of wing deep vermilion. Olivaceous-gray above, the wings and tail strongly tinged with red; crest only dull red, without darker shaft-streaks. Beneath wholly light ochraceous. No black around bill.

A. Crest-feathers soft, blended. Rump not lighter red than back.

a. Black of the lores passing broadly across forehead. Crest brownish-red. Bill moderate.

Culmen, ·75; gonys, ·41; depth of bill, ·54. Feathers of dorsal region broadly margined with grayish. Wing, 4·05; tail, 4·50; crest, 1·80. *Hab.* Eastern province of United States, south of 40°. Bermudas . . . . . var. VIRGINIANUS.

b. Black of the lores scarcely meeting across forehead; crest pure vermilion. Bill robust.

Culmen, ·84; gonys, ·47; depth of bill, ·70. Feathers of dorsal region without grayish borders; red beneath more intense; wing, 3·60; tail, 4·20; crest, 2·00. *Hab.* Eastern Mexico (Mirador; Yucatan; "Honduras"). . . var. COCCINEUS.*

Culmen, ·82; gonys, ·47; depth of bill, ·65. Feathers of dorsal region with distinct gray borders; red beneath lighter. Wing, 4·00; tail, 5·00; crest, 2·00. *Hab.* Cape St. Lucas and Colorado basin of the United States; Tres Marias Islands. (Perhaps all of western Mexico, north of the Rio Grande de Santiago) . . . . . var. IGNEUS.†

B. Crest feathers stiff, compact. Rump decidedly lighter red than the back.

Culmen, ·75; gonys, ·41; depth of bill, ·57. Dorsal feathers without grayish margins; red as in the last. Wing, 3·40; tail, 3·80; crest, 2·00. *Hab.* Western Mexico; Colima. "Acapulco et Realejo." . . . . . var. CARNEUS.‡

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*Cardinalis Virginianus, var. coccineus Ridgway. Am. Jour. Arts & Sci., Dec., 1872.

†Baird. P. A. N. S., Nov., 1859, p. 305.

‡Cardinalis Virginianus, var. carneus Ridgway, Am. Jour. Arts and Sci., Dec., 1872. ?Cardinalis carneus Less., R. Z. 1842, 209.— Bonap., Consp., i, 501. According to the locality quoted ("Acapulco et Realejo") this name is the one to be applied to the variety diagnosed in the synopsis; it is difficult, however, to make anything out of the description, as it is evidently taken from a female or immature bird. If the locality quoted be correct, this form ranges along the Pacific coast southward,

C. Phœniceus.* Culmen much arched; commissure arched; upper mandible not as deep as lower, and with grooves forward from the nostril, parallel with the curve of the culmen. Bill whitish-brown. Black patch restricted to the chin, its posterior outline deeply concave.

Crest feathers stiff and compact. No black above, or on lores; crest pure vermilion; rump light vermilion, much lighter than the back, which is without gray edges to feathers. Culmen, ·75; gonys, ·39; height of bill, ·67; wing, 3·50; tail, 3·90; crest, 2·20. *Female.* Lining of wing buff; above ashy-olivaceous, becoming pure ash on head and neck, except their under side. Crest feathers vermilion with black shafts; no red tinge on wings, and only a slight tinge of it on tail. Fore part of cheeks and middle of throat white: rest of lower part deep ochraceous. Black around bill as in male. *Hab.* Northern South America, Venezuela; New Granada.

ON THE OVIPOSITION OF THE YUCCA MOTH.

BY PROF. CHAS. V. RILEY.

To complete the natural history of *Pronuba yuccasella*, a description of the method of oviposition is necessary. In a former article on this insect occur the following sentences:—

"For want of sufficient time, I have been unable to catch the moth in the act of oviposition; but from careful examination, I am satisfied that the eggs are not deposited on the outside of the fruit. They are either thrust into it from the side or from the stigmatic opening, following, most probably, the course of the pollen tubes. I strongly incline to the latter view, for, though many Lepidoptera are furnished with extensile ovipositors, which enable them to thrust their eggs into crevices and other orifices, I know of none which actually puncture, nor have I been able to discover any trace of punctures leading to eggs.

Neither have I been able to discover the egg *in situ;* which is not to be wondered at, however, as when examined in the female abdomen it is found to be long, narrow, soft and flexible, and of the exact color of the flesh of the young fruit. The ovipositor is so very fine and extensile that it may be thrust into the most minute and narrow passage."

probably from latitude 20° as far at least as Nicaragua. North of 20°, and on the Tres Marias Islands, it is replaced by var. igneus, and on the Atlantic coast, from Tampico south to Honduras, is represented by the var. coccineus.

In the very long, stiff crest-feathers, and light red rump, this variety of C. Virginianus closely approximates to C. Phœniceus, but in other respects is very distinct.

*Cardinalis Phœniceus (Gould) Bonap. P. Z. S., 1837, p. 111; Consp., i, 501.—Sclater & Salvin, Ex. Orn., Pt. viii, 1868, pl. xliii.

Analogy has proved an unreliable guide in this instance, as, indeed, it often does in natural science; while the curious ♀ *Pronuba* adds one more to the anomalies which belong to her. She *does puncture* the young fruit and convey her eggs into it from its side.

The yucca flowers are fully opened and perfect during a single evening and night only, and it is during this, the first night of blooming, that eggs are consigned to the somewhat prismatic pistil. The pollen grains are not so often expelled, to fall on the inside of the flower, as I had been led to suppose; but almost always remain in an entire lump on the contracted and curled anthers. The moth, consequently, has no difficulty in accumulating her little load of pollen, for a single anther furnishes nearly the requisite amount.

Once equipped with this important commodity, she may be seen either crawling over or resting within the flower. From time to time she makes a sudden start, deftly runs around and among the stamens, and anon takes position with the body between and the legs straddling some two of them — her head turned toward the stigma. As the terminal halves of the stamens are always more or less recurved, she generally has to retreat between two of them until the tip of her abdomen can reach the pistil. As soon as a favorable point is reached — generally just below the middle — the lance-like sheath of the ovipositor, which consists of four converging, corneous bristles, is thrust into the soft tissue, held there a few seconds while the egg is conducted to its destination, and then withdrawn by a series of up and down movements. So intent is she upon this work that after the ovipositor once penetrates the pistil the whole perigon may be detached, some of the encumbering petals and stamens removed, the insect brought within the focus of a good lens and all her movements observed to the greatest advantage, without disturbing her. In this way I have been able to watch the consignment of hundreds of eggs, and to admire the delicacy and elasticity of the ovipositor proper, which issues from the setaceous sheath in a silk-like thread, almost invisible to the naked eye and as long as the terminal abdominal joint; and which stretches and bends according as the body is raised or lowered.

No sooner is the ovipositor withdrawn into the abdomen than the moth runs up to the top of the pistil, uncoils her pollen-bedecked tentacles, thrusts them into the stigmatic opening, and

works her head vigorously as I have previously described — the motion being mostly up and down and lasting several seconds. This carrying of the pollen to the stigma generally follows every act of oviposition, so that where ten or a dozen eggs are consigned to a single pistil, the stigma will be so many times be-pollened. The ends of the tentacles, which are most setose and spiny, and which are always curled into the pollen-mass when not uncoiled, must necessarily carry a number of pollen grains each time pollination takes place; and I have noticed a gradual diminution in the size of the collected mass, corresponding, no doubt, to the work performed, which is indicated by the rubbed and worn appearance of the individual — the freshest specimens always having the largest loads.

While oviposition is generally followed (and not preceded as I formerly supposed) each time by pollination, yet the former sometimes takes place twice, thrice or oftener without the latter being performed; and I suspect that the converse of this is equally true.

Although often marking the exact point at which the puncture was made, it is so very fine and the fruit tissue so soft and succulent that I never succeeded in tracing the passage to the locus of the egg until I dipped the pistil in ink. If carefully done, without bruising the surface or allowing t e ink to run in at the stigma, the fruit, by this operation, will be discolored only where the ink has followed the recent puncture, which may then be traced by means of a lens; though by extraordinary practice and manipulation it might doubtless be traced under the microscope, without such aid. The egg is very narrow and elongate, soft, flexile, rather translucent, pointed anteriorly and of the exact color of its surrounding. It lies curved in the ovarian cavity, always on the rounded side next the primary dissepiments (in the cases I have noticed) and with the anterior end for the most part close to the placenta. These facts are best ascertained a day or two after the fruit is plucked, when, in the ink-dipped specimens, a sunken black cicatrice forms around the mouth of the puncture, and the ovarian cavity enlarges by the shrinking of the adjoining tissues. I have little doubt but that the egg increases in bulk before hatching, under the influences of impregnation and endosmosis, and Dr. Engelmann tells me that he has been able to trace the embryo larva under the extremely delicate egg-covering and to observe it curled up at the anterior end of the egg which greatly enlarges.

This larva hatches on the fourth or fifth day after the laying of the egg, and usually commences feeding between two ovules, which, in consequence of its action, swell abnormally. Thus in making a longitudinal section of the fruit these swollen ovules often indicate the presence of the worm where it would otherwise be overlooked while very small.

While oviposition generally takes place in the manner described, the moth head outwards and straddling two stamens, an entirely opposite position must sometimes be assumed, since larvæ and punctures are not unfrequently found in the upper part of the fruit, especially where a single one is stocked with ten or a dozen larvæ, as is sometimes the case.* As the fruit enlarges, the mouth of the puncture forms a slight, discolored depression, more noticeable in some varieties than in others; but the passage-way becomes obliterated.

My observations this summer might be extended much in detail. They have convinced me more than ever that *Pronuba* is the only insect by the aid of which our yuccas can be fully fertilized; for I have studied this fertilization diligently night after night, without seeing any other species go near the stigma. The stigmatic opening closes after the first night and I know of no crepuscular or nocturnal species which could collect the requisite amount of pollen and bring it so to bear on the stigma that each ovule would receive the influence of a pollen grain. The species already enumerated† as frequenting yucca are mostly diurnal and have nothing to do in the work; and wherever I have excluded the moth from the flowers, by enclosing the latter with netting, no fruit has been produced. I am therefore led to believe that the few rare instances of yucca-fertilization, in localities where *Pronuba* may be presumed not to occur, have been brought about by another insect accidentally, or by the stamens reaching an exceptional length, and the anthers being brought into contact with the stigma by the conniving of the closing petals. I have found the stamens of varying length in the flowers on the same panicle and in some instances almost as long as the pistil.

It is my intention to obtain a large number of cocoons this year and it will give me pleasure to distribute them among those who

* I have counted as many as twenty-one larvæ in a single capsule of what is apparently *Y. flaccida*.

† Trans. St. Louis Ac. Sc., iii, No. 1, p. 59.

grow the yucca in those parts of this country or in Europe where seed is not produced. The cocoons will be best sent in early spring and should be buried three or four inches beneath the soil at the foot of the plant.

REVIEWS AND BOOK NOTICES.

Prehistoric Races of the United States.*—Had the so-called Indian never existed in North America, it would, we think, have been a more satisfactory undertaking to endeavor to solve, from existing data, the mystery of that forgotten people of this continent, now known as "Mound-builders." Careful as one may be, it is impossible to avoid uniting the traces of the two people, especially when describing stone implements, while professedly treating of but one of these races. Even among the many relics of the redman found in the Atlantic states, there are frequently gathered single specimens, that seem applicable to the mound-builder rather than to the Indian; so, judging from relics of this character only, there seems to be a closer tie between the two peoples than the learned author of the volume before us is disposed to admit. Such is the impression made by a careful perusal of that portion of the work which describes the stone implements found in and near the earthworks referable to the mound-builders; and it is the copper weapons and pottery that distinguish this people, studied only by the smaller relics that are found; for no stone implement occurs in the mounds, or is otherwise assignable to the mound-builders, that is not also characteristic of Indian "finds." When, on the other hand, we familiarize ourselves with the wonderful mounds, for temple sites, for sacrifice and sepulture, and with the long lines of an enclosure for defence and other purposes, then indeed, we see abundant reason for drawing the lines between the people who erected them and the ruder redmen; and admitting that "a broad chasm is to be spanned before we can link the mound-builders to the North American Indians."

* Prehistoric Races of the United States of America. By the late J. W. Foster, LL.D. Chicago, S. C. Griggs and Co. 8vo, cloth. pp. 415. Illustrated.

In the opening chapters of the book, Dr. Foster gives an admirable résumé of the evidences, in Europe and in the United States, of the antiquity of man; and follows these chapters with others on the geographical distribution of the works of the mound-builders; shell-banks (which are as referable to Indians as to mound-builders); the construction of the mounds; the arts and manufactures of their builders, and also, on their copper-mining operations at Lake Superior.

Succeeding these, is an exceedingly interesting chapter on the crania of the mound-builders, and then, after discussing manners and customs as the basis of ethnic relations, the author asks in chapter x, "Who were the mound-builders?"

We have not the space to enter into a detailed analysis of the several chapters, briefly noticed above, although embracing so many subjects that are of steadily increasing interest to American archæologists. As the main object of the work, however, is to solve the deep mystery of the origin and fate of the mound-builders, it is well that Dr. Foster's own reply to these questions should be given. He writes, with reference to the first of these, "Instead of seeking to establish ethnic relations between the mound-builders and any of the races of the Old World, founded on the apparent similarity of manners and customs, I would look rather for their origin to that race who, in times far remote, flourished in Brazil, some of whose crania are found in the bone-caves of Minas Geræs, in connection with mammalian bones belonging to genera and species now extinct."

With reference to their fate, while occupants of the territory where their earthworks now are found, he remarks: "The distinctive character of the mound-builders' structures, and also the traditions which have been preserved, would indicate that this people were expelled from the Mississippi valley by a fierce and barbarous race, and that they found refuge in the more genial climate of Central America, where they developed those germs of civilization, originally planted in their northern homes, into a perfection which has elicited the admiration of every modern explorer."

We have here two very clearly expressed ideas as to the origin of the mound-builders in North America, and of their departure therefrom. Dr. Foster does not believe, as we have seen, in an *extra*-American origin of this people; but seeks it rather in the

discovery, by Dr. Lund, in Brazil, "of human bones of both sexes entirely preserved and partially petrified; in fact, truly fossil bones, mixed with those of gigantic and extinct animals,*" "and points out the similarity of the crania from Brazil with authentic mound-builders' skulls, that similarity being "a remarkable deficiency of the frontal eminences, amounting to an almost entire absence of the forehead," and further adds, "a type which we find delineated on the monuments of Mexico and Central America and which is seen in the crania recovered from the shores of Lake Michigan and the banks of the Wabash and Mississippi."

These mound-builders' skulls, it appears, from Dr. Foster's researches, "differ on the one hand from the Indian type, which is brachycephalic, and from the Teutonic, on the other, which is dolicocephalic. They are intermediate, or orthocephalic;" and, after giving some craniological details, adds, "I think we are justified in drawing the conclusion that the mound-builders were not the ancestors of North American Indians."

The conclusion drawn being that orthocephalic mound-builders could not or did not degenerate into redmen, who according to Retzius are brachycephalic, "on that side of our continent which looks towards Asia and the isles of the Pacific" and dolicocephalic along the Atlantic seaboard, being nearly related to the Guanches of the Canary Islands, and the Caribs—but that "the primeval people of Brazil, the Huanchas of Peru, the platform builders of Mexico and the mound-builders of the Mississippi Valley" were closely allied people. Of these, however, Dr. Foster distinctly states that the latter are orthocephalic; while Retzius describes the others as decidedly dolicocephalic. If therefore both authors are correct, we cannot trace the connection between the mound-builders, as described by Dr. Foster, and the races described by Retzius, to whom our author refers so frequently, as to the characteristics of their crania. And, on the other hand, if the orthocephali are derived from dolicocephalic autochthones of Brazil, why may not their descendants have become, by sexual selection, brachycephalic redmen, or indeed reverted to the ancestral dolicocephalic form? The fossil men of Minas Geræs may be the ancestors of the mound-builders, but do the craniological details brought forward by Dr. Foster, of themselves prove it?

*Journ. Anthrop. Inst. London: Vol. ii, p. 408.

A word more, and we have done. We have asserted that our author did not seek, out of America, for the origin of the American races. Such would seem to be his opinion, when he asks the question (chap. x) "Who were the mound-builders?" and also in discussing "manners and customs as the basis of ethnic relations:" but in chapter xi, we find Dr. Foster asserting that he doubts not "that there will be found continuous and uninterrupted causes which shall explain all the diversities in the different branches of the human family, without the necessity of resorting to independent creations." To this we cannot subscribe, and think we see in it a contradiction to the whole tenor of the preceding chapters.

The antiquity of the redman in America can scarcely be measured; it is probable that he "witnessed the declining existence of the mastodon and megalonyx, in the later ages of the glacial period*" — that of the mound-builder can scarcely be greater, and efforts to trace his origin "to a common fountain of life, as with other races now inhabiting the earth, soon involve the investigator in the mazes of conjecture."

We learn from the preface of the volume before us, that Dr. Foster hoped at a later day "to draw more liberally from the materials at his command." It will ever be a source of regret that his untimely death has forever ended his valuable labors in American archæology. Valuable and interesting as is the work we have briefly reviewed, we doubt not but that a more comprehensive monograph from the same gifted source would have overcome many of the difficulties that now beset the path of American archæologists.—C. C. A.

Classification of North American Beetles.†—Since his recent return from a stay of several years in Europe, Dr. LeConte has applied himself to the study of our beetles, and with what success may be seen in the amount of work contained in the two pamphlets we notice in this number of the Naturalist.

Though this second part is much smaller than the first, and treats of but two families, the Spondylidæ and Cerambycidæ, yet the work is done in the same thorough, comprehensive way that

* Dr. Jos. Leidy, in Indigenous Races of the Earth, p. xviii.

† Classification of the Coleoptera of North America. Prepared for the Smithsonian Institution by John L. LeConte, M. D. Part ii. Washington, May-June, 1873. 8vo. pp. 69.

characterized the first, and which places the author, in his masterly grasp of the subject, foremost among the living writers on Coleoptera.

Each family of beetles is fully characterized, with detailed descriptions of the subfamilies, tribes, and brief diagnoses of all the genera, together with interesting remarks of a general nature. The work when completed will necessarily be a complement as well as supplement of Lacordaire's famous "Genera of Coleoptera," and will invite the attention of European entomologists, while in America it will be the Coleopterist's *vade mecum*.

New North American Beetles.*—Dr. LeConte, in this second part of "New Species of North American Coleoptera," describes eighty-nine new species of beetles, mostly from the Pacific coast. A number of new genera are also characterized.

BOTANY.

Flowering of Aplectrum.—With us the flowering of *Aplectrum hyemale* Nutt. appears to be an exceedingly rare event; so much so, that close watching of the plant in our woods, for several years, on my part, has been unrewarded by a single instance of its blossoming. The experience of others corroborates the conclusion that it is a shy bloomer, at least in Michigan. I am anxious for information on the point referred to, as regards other localities. A friend once succeeded in obtaining the flowers by taking up the plants in the spring, and keeping them in saucers of the rich black mould which the Aplectrum loves so well, thoroughly moistened. A plant which I once potted sent up a fine scape, several inches high, but, owing to the want of proper care during my absence from home, it did not come to perfection.

The Aplectrum was formerly well represented in the woods north of Detroit; but the encroachment of the city is fast destroying the station which was remarkable for the abundance of this rather scarce plant. However, it is, even now, far from exhausted. On the 20th of April, 1873, I took from a space about ten feet square, in a piece of beech woods, thirty of these plants, which I

*New Species of North American Coleoptera. Prepared for the Smithsonian Institution by John L. LeConte, M.D. Part ii. (Smithsonian Miscellaneous Collections (261), Washington, May-June, 1873. 8vo. pp. 71.

transferred to my garden, in the hope of seeing them blossom. I shall duly communicate the result. Some years ago, I gave several handsome roots to a Boston friend, for cultivation; but I have not heard since regarding them. Some which I have kept potted for three years invariably send up every summer their large, many-plaited leaves, which remain throughout the winter as usual; but the flowers are not produced. It may be that, in order to procure the desired result, the pot should not be kept housed during winter, but remain plunged in the open ground.

I have thought that perhaps the destruction of the native forest, depriving the plant of some element necessary to its perfect development, is the cause of its so seldom or never blossoming here. This is a suggestion worthy of note as regards the history of other plants as well as of this one. Of late years the Aplectrum is, with us, of less luxuriant growth than formerly.—Henry Gillman, *Detroit, Michigan.*

A Yew Flowering in Winter.—About six weeks ago I nipped a small spray off a dwarf yew tree, protruding through the snow, in my neighbor's garden. It was my intention to press it; but for immediate convenience it was put in a glass of water, in the sitting room, and for some time no more was thought about it. A few days ago (Feb. 7), I was astonished to find a number of full blown flowers on the spray. These pretty, diminutive objects were accompanied with an interesting phenomenon. The anthers kept up a little fusillade of explosions, throwing off the yellow pollen in tiny clouds. My thumb nail, which happened to be near one of the little globular catkins about as large as a canary's eye, was quite yellow with the ejected powder. I shook off some on the slide of a microscope. They were, in form, when under a lens of high power, like angular pebbles, and although I had barely touched the slide with my nail, yet the number of pollen grains under the microscope was innumerable. To me, this affair was intensely interesting, and a very pleasant episode in a sick room. The entire process can doubtless be repeated by any one, with the certainty of success, even in midwinter. The pretty little strangers still continue blooming on my table, and impart a cheeriness to this unusually bleak St. Valentine's Day.—S. L., *in Monmouth Democrat, Freehold, N. J.*

VARIATIONS IN MEDEOLA AND UVULARIA.—On the 17th of June, 1872, I found in the woods near Fredericton, N. B., a specimen of *Medeola Virginica* (not rare in these parts), possessing the following unusual characteristics.

The whole plant was about eighteen inches high. Instead of the usual whorl of leaves near the middle of the stem, the whole of these were clustered at the summit, there producing a sort of double whorl, of twelve leaves in all, the lower and outer being of the usual size and gradually becoming smaller and oval-lanceolate towards the top, thus embracing the upper whorl of three leaves usually found beneath the flower. The latter was still more anomalous in character, the *single* blossom (which was *erect*, and not recurved, upon a short stout peduncle) having one petal recurved between two of the sepals, which with the remaining petals were alike and spreading, with incurved edges. Within the perianth were four other bodies, apparently petals, but somewhat stamen-like in aspect, followed by three good and three apparently abortive stamens, the whole surrounding *six* dark purple stigmas! Are these results the effect of an effort at reversion, or are they due to a partial consolidation of the two or more flowers usually found in the same situation — or both?

Another curiosity, though less remarkable than the last, and recently observed by me, is a specimen of *Uvularia sessilifolia* possessing *three* well formed flowers instead of the solitary one or rarely two, described in Gray's Manual as usual with the plant. Both of the above specimens were preserved and are now in my herbarium.—L. W. BAILEY.

A NEW BALLAST WAIF. — Kaighn's Point, opposite Philadelphia — a place where ballast is discharged — is noted for the foreign plants which appear there year after year, some of which are disposed to remain. To the list of such plants which has been published we may now add a remarkable one, *Calycera balsamitifolia*, a native of Buenos Ayres, a representative of a singular small family, nearly allied to *Compositæ*, and peculiar to extra-tropical South America. It was collected by Mr. Isaac Burk, and determined by Dr. H. Leffmann of Philadelphia.—A. G.

ZOOLOGY.

THE PRESERVATION OF THE LOWER ANIMALS.—I have the honor of making known to the class two methods that I have employed at Helgoland, during the last season, for the preparation and preservation of Medusæ, Ctenophoræ, Noctilucæ and most of those lower forms, transparent as crystal, which live at the surface of the sea, and which the use of the towing net furnishes in abundance. I submit to the class different Medusæ (Oceania, Geryonopsis), Ctenophoræ and some Noctilucæ prepared for several months, and remarkable for their perfect preservation.

One of these methods consists in the use of a weak solution of osmic acid, the other in the use of picric acid.

Osmic acid has been constantly employed in histology, especially for the study of the nerve-terminations, and Max Schultze has made known, by his beautiful researches on the structure of the retina, all the advantages which the use of this reagent presents. Not only does the osmic acid harden the most delicate tissues and organs, allowing us to make fine sections, but it possesses the valuable property of coloring brown, afterwards black, the fatty parts in general, and more particularly myeline. It tints in brown epithelial cells and muscular tissues; it renders very apparent the fibrillar structure of the cylinder of the axis of nervous fibres, and brings out clearly the isolated nerve fibrillæ. Very recently, F. S. Schultz has employed with great success osmic acid for his beautiful histological researches on *Cordylophora lacustris*. This reagent indicates admirably the limits of the cells and brings out well their different characters.

I have used osmic acid to prepare Medusæ and Ctenophoræ, in order to save them from the destructive action of alcohol, in the following manner. The object is placed in a very feeble solution of osmic acid, for a time varying, according to the nature of these minute organisms, from fifteen to twenty-five minutes. After this lapse of time the animals are colored pale brown; the cells of the endoderm and the organs attached to the endodermic layer are alone colored, and the other tissues preserve their original transparence. Thanks to this coloration of the endodermic cellules the gastro-vascular canals are admirably indicated, and the cirrhi become more distinct than in the small, living Medusæ. At the same time all the

tissues harden, and we can then withdraw from the acid solution the objects which have been submitted to its action, wash them carefully several times, and then place them in strong alcohol without running the risk of finally destroying either their elegant forms or the transparence of their tissues. We can even after several weeks, and probably after several months, study the organization and the structure of these delicate beings as well as if we had them living under our eyes.

Another method that I have employed with success consists in the use of picric acid in a concentrated aqueous solution. I have preserved in this liquid, for about six weeks, small Medusæ (Oceania) and Noctilucæ. We only notice that the small Medusæ, which are perfectly transparent in life, have become plainly opaque. I have examined microscopically some Noctilucæ thus preserved, and can state that they appear just as they came from the sea.—E. VAN BENEDEN.

THE AVI-FAUNA OF COLORADO.—Dr. Coues, in the June number of the NATURALIST, criticises the Holden-Aiken list of the Birds of Colorado. So far as his criticism has any pertinence, it would seem to be to complain of the incongruity of grouping in the same list birds found in northern and in southern portions of this territory. If this were the first time that local lists were made, based on political and disregarding natural lines, it would perhaps be worth while to discuss this point. Or I might fall back upon my reserved rights, and, while allowing to my critic the full right to his individual opinion, claim the right to differ, *toto cœlo*. Or I might cite, in extenuation of my offence, a well known list of New England Birds, in which "such birds as" the hooded warbler and the Canada jay "find themselves in ornithological company they never saw outside of a book—" or that of the birds of Arizona, or of South Carolina wherein similar forced associations are only possible *cum longo intervallo*. But my transgression is one for which I propose to make no excuse, and for which I do not need even such illustrious examples; and I would not now have referred to this critique but for an unfortunate error which I deem it important to set right. Facts are more valuable than mere unsupported theory, and illustrations are peculiarly unfortunate when they contradict instead of confirming an hypothesis. Such is the case with my critic. To demonstrate the impropriety of the

Holden-Aiken list, Dr. Coues says "such birds as *Geococcyx Californianus* and *Pipilo mesoleucus* find themselves in ornithological company they never saw outside of a book." Now so far from demonstrating the incongruity of this list, the sentence I quote proves the need of it. It enables us to teach even so good an ornithologist as our critic, and it also shows that it is never safe to argue on merely negative ground. The illustration he has chosen, so far from confirming, refutes his objections. Mr. Aiken informs me that not only are both of these birds found in Colorado, even in the same county, but that he knows positively of several instances in which *G. Californianus* and *P. mesoleucus* have been seen within a few rods of each other. A valid reason might also be urged for the absence, in the list, of any description of *Junco Aikeni*, but it would not interest your readers to hear it: enough that it was both unavoidable in itself, and a postponement rather than an omission.—T. M. Brewer.

Malformations.—Last winter one of our pupils at New Brunswick, N. J., communicated the fact that he had purchased, the previous autumn, of a huckster woman in Newark, a pair of young ducks, each having four wings. The woman had twelve for sale, and said that the eggs were laid by a well formed bird; that she hatched a brood of sixteen, every one of them having four wings. The youth said that his birds used both pairs of wings in flying, that is, in moving rapidly on the surface of the pond. They did not live long. Whether this was due to any defective vitality in the birds, or to any extraneous cause, could not be learned.

But we turn from these traditionary facts to a catastrophe, which our own eyes have inspected, as having befallen a family of cats.

About a mile and a half from Freehold, N. J., lives an intelligent family who have had for several years an annual litter of malformed cats. Several years ago a young male cat was brought from Allentown, some twenty miles distant. This cat had a deformity in one front foot, which had six toes. It coupled with a cat of normal form and parts, and a litter of four or five was the result, all with six-toed front feet. The she cat became troublesome, getting into the pantry, and so was sent off. The kittens were disposed of except one. With this the paternal cat united, and the result was four kittens each having six toes on each forefoot, and five on each hind-foot. This intermixing, as I under-

stand, by this Grimalkin Turk, has gone on for some four years, and to-day, July 29th, I examined one of his daughters, some three months old, which has *six toes* on each of the hind-feet, and *seven toes* on each of the fore-feet. The fore-feet are bifurcated; that is, they have, as it were, each two paws to one foot, the outer paw of each foot being much the larger, and having four toes; and the inner, or smaller paw, on each foot, having three toes. This kitten was one of a litter of four, all malformed precisely alike. On some points I could not get the exact information desired. But I should think that the vitality of these cats is becoming less and less, as they do not become common. To me it seems astounding when I attempt to conceive of the physical equation which enters into this erratic conception — the minuteness of the abnormal material which, plus the normal substance as imparted by the spermatozoön, gives the initial impulse to a result so eccentric. If, as Goethe declared, "It is in her monstrosities that Nature reveals to us her secrets," one would like to know something of the mode and motive of such a distribution of the life force. During our inspection of Miss Tabbie it was all very well so long as we stroked her back with one hand. She purred as expressive of true feline luxuriousness; and, what is not common, she even licked the other hand as indicating affection. But when we meddled with her extremities, she evidently regarded it as taking personal liberties with unpleasant peculiarities; and instantly rewarded our duplicity by investing in our hand the seven talons concealed in that duplex napkin.— SAMUEL LOCKWOOD.

THE "WILLOW WANDS" FROM BURRARD'S INLET.— I have been able definitely to place the above, referred to by my friend "W. H. D.," on page 488 of this volume of the NATURALIST, by the receipt in this city of several specimens in good preservation. The "wands" or "switches" prove to be what the majority of scientific gentlemen who had seen specimens, supposed, viz., the central stalks or axes of Alcyonoid polypes, but do not belong to the genus *Umbellularia* as suggested by me, but to a new species of *Pavonaria*, which I have described in the "Mining and Scientific Press" (August 9th) of this city, under the name of *Pavonaria Blakei*. It is a beautiful form resembling in a general way the British species *P. quadrangularis* from Oban. The most perfect specimen, but not the largest, displayed some 245 Λ-like rows,

and numbered about 5000 individual polypes. With *P. Blakei* were received specimens of *Pennatula tenua* Gabb, described in Proc. Cal. Acad., vol. ii.—R. E. C. Stearns, *San Francisco.*

The Kingfisher.—In a recent number of the Naturalist is a note by Dr. Abbott contradicting Darwin's statements as to the manner in which the kingfisher (*Ceryle alcyon*) takes its food. Permit me to add my testimony in favor of Darwin. Having observed the habits of birds for some years I can say that the kingfisher divides its food by means of its bill, before swallowing. The smaller fish being soft are easily crushed and divided while being swallowed. The larger fish are frequently partially swallowed and so carried to a convenient perch and there disgorged, and then a few strokes of the bill divide it ready for digestion. A dissection of a kingfisher will show the above to be the case.—E. E. Breed, *Duluth, Minn.*

The "Horned Toad."—It may be of some interest to the readers of the Naturalist to know that the common horned toad (*Phrynosoma cornuta*) produces a large number of young at a single birth. Last summer Mr. George Eddy of this city brought me a toad which had given birth to twenty-five little ones, and two weeks ago (July 14) a boy called after me and showed me a toad which only two hours before had given birth to twenty-seven. The young were exceedingly active and could run as rapidly as the old one.—John Wherrell, *Leavenworth, Kansas.*

The Black Snowbird Breeds on the Graylock Range.—I have for some time suspected that the black snowbird (*Junco hyemalis*) breeds on the mountains of this region; but I have never found the nest of this bird here till to-day. To-day I found the nest, with two eggs, on one of the hills belonging to the Graylock range. It was on the ground just under the edge of a little bank and was made of dried grasses and lined with black hair.

Jacob Horton, of the senior class in this college, found the nest and eggs of this bird on Graylock a few days ago.—Sanborn Tenney, *Williams College*, Aug. 6, 1873.

Addition to the Avi-fauna of America.—One of the birds obtained by our party in the Aleutian Islands during last season, with an incomplete set of eggs, was forwarded by Prof. Baird (to whom the specimens were submitted) to Mr. Harting of London;

it is the *Tringa crassirostris* of Temminck and Schlegel, a species hitherto known only from eastern China and Japan, and an interesting addition to our northwestern fauna.—W. H. DALL.

GEOLOGY.

ON A FEW MINERAL LOCALITIES WHICH ARE NOT MENTIONED IN THE BOOKS.—Beryl occurs sparingly in the southern part of Sullivan, New Hampshire. I have an absolutely perfect crystal, both terminations perfect, from this place. Dana mentions beryl from Sullivan with a query.

From Alstead, N. H., I have obtained crystals of beryl which have yielded the most beautiful gems. The beryl here is found near the well known mica quarry. In the mica quarry itself there occurs an interesting variety of albite, containing prominent scales of a silvery colored mica. The small crystals of beryl from the old mica quarry are remarkable for their modified terminations.

In Gilsum, N. H., I have obtained crystals of beryl, and fine crystals of mica. I found them in a cut made through the coarse granite, for the highway, between Gilsum and Marlow.

A mile or two northwesterly from the centre of the town of Acworth, N. H., and on the north side of the old highway from this town to North Charlestown, there is a locality of blue kyanite, an account of which, however, I gave at the Troy meeting of the American Association for the Advancement of Science. The kyanite will be seen, by the careful observer, on the stone wall by the wayside, and it is found in place a little to the northward of the wall. A variety of kyanite (fibrolite?) is common in the mica slate of the eastern part of Marlow, N. H. Black tourmaline also occurs in this town.

Plumbago occurs sparingly in the last named town; also more abundantly in Weare, N. H. The fact of its occurrence in Weare may have been recorded before. I am not sure about it.

Acicular crystals of rutile in perfectly limpid quartz occur as bowlders in the southern part of New Hampshire. I have one of these which I obtained in Jaffrey, N. H., but of its exact locality I am not now sure. I may here add that I have a similar specimen from the northern part of Vermont, and from the fact that not a few specimens of this sort have been found in these two states, it is evident that somewhere to the northward there is an important locality of this mineral.—SANBORN TENNEY.

THE "GLADES" OF MARYLAND.— Will you call the attention of geologists who may be passing over the Baltimore and Ohio railroad to this very peculiar region? From a bird's-eye view which I had from a summit, a little north of Oakland station, in Alleghany county, I am satisfied that these meadows were the seat of ancient glaciers. If this is so, it brings the former glacier level of the Alleghanies much lower than has heretofore been supposed; that is to say down to 2400 or 2500 feet above mid-tide at Baltimore. — GEORGE GIBBS, *New Haven.*

BOWLDERS.— I believe it has long been known that in many cases bowlders are formed by exfoliation and disintegration in the very situations in which we find them. Fine examples of granite bowlders of this sort occur near the ordinary stage road about five or six miles, more or less, north of the Yosemite.— SANBORN TENNEY.

ANTHROPOLOGY.

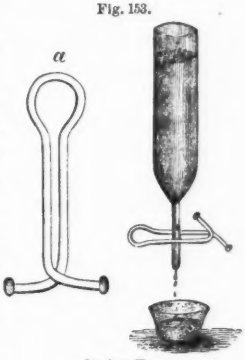
THE AGE OF THE FAMOUS GAUDELOUPE SKELETON.—M. Hamy has just made, at the Museum of Natural History at Paris, a discovery of much interest in relation to the age of the famous Gaudeloupe skeleton. He found in one of the blocks containing a skeleton of a child eight years old, an amulet of jade, representing a batrachian. This jewel he pronounces to be of Carib origin. Rochefort and Du Tertre speak of the fondness of the primitive inhabitants of this archipelago for certain green and red stones, and especially those which had the form "grenouille" (frog). The block was carried to Paris at the same time as the one enclosing the skeleton examined by Cuvier. *Abridged from the Paris "Journal des Débats."*

MICROSCOPY.

A NEW CHIMNEY FOR MICROSCOPE LAMPS.—Mr. Wenham uses as a chimney a cylindrical brass tube with a space cut out of one side, which space is closed with an ordinary glass slide held in place by a spring clip. The tube is not liable to accident, and the perishable part, the glass slip, can be instantly replaced wherever the microscopist may be, while the peculiarly shaped glass chimneys, commonly used on microscope lamps, cannot be obtained away from the large cities.

Separating Diatoms.—In cleaning diatoms, and in preparing other microscopic specimens, it is often necessary to decant part of the fluid in a vessel without disturbing the remainder, in order to separate those objects or particles which are heavy and settle promptly from those which are lighter and remain longer diffused through the liquid. When no great nicety is required, the upper portion of the liquid may simply be poured carefully off from the lower; as in washing sediments, where all but the heavier part is to be thrown away. A much better separation is accomplished by a syphon, either the upper or the lower portion, preferably the latter, being quietly drawn off by this means. This apparatus is so simple as to be easily made and managed, and easily cleaned for subsequent use. Of the more complicated contrivances for this use, one of the best is Benning's (See Nave's Collector's Hand Book of Algæ, etc., London, 1869, p. 26), which consists of a tall jar with a series of stop-cocks or taps at various heights, the water containing the objects being conducted by a funnel to the bottom of the jar, and the objects escaping with the water from the various taps according to the readiness with which they settle through the water. Another plan, a modification by John H. Martin of a previously used apparatus (see Martin's Manual of Microscopic Mounting, London, 1872, p. 24), consists of a closed cylinder with several tubes leading through the top, the lower ends of these tubes opening inside of the cylinder at different heights, and the fluid being forced out through them by the pressure of a column of water carried in a flexible rubber tube. The disadvantages of these contrivances are their complexity, difficulty of cleaning, and danger of imperfect cleaning. A simpler arrangement is to use a tube drawn out to a funnel-shape at the bottom, and closed below by a spring-tap consisting of a rubber tube pressed together by a wire spring as represented in the cut. This apparatus, described in the "Collector's Hand Book" (p. 22) and elsewhere, is easily worked and cleaned, and eminently satisfactory. Though much used abroad, it has scarcely been adopted in this country.

Fig. 153.



Spring Tap.

NOTE ON A NEW $\frac{1}{15}$ OBJECTIVE.— In the NATURALIST for August appears the announcement that "Mr. Tolles has recently completed a $\frac{1}{15}$ objective perfectly satisfactory to himself." Now the fact is Mr. T. never constructed an objective of any power "perfectly satisfactory to himself," and I really think it necessary to put in a plea in abatement to this effect.— ROBT. B. TOLLES.

WALES.—Wm. Wales, who has been abroad this summer, has returned to Fort Lee, N. J., and resumed work in the construction of his well-known and much-used objectives.

NOTES.

AT the second meeting of the Agassiz Natural History Club, held at the Anderson School of Natural History, July 30th, Mr. Jordan gave an account of two algæ common on our shores, known as *Chordaria flagelliformis* and *Dictyosiphon feniculæcus*, which have been considered as distinct plants and referred to different orders. Areschoug suggested, some time ago, that the latter was but an abnormal state of the former, but this view has not been accepted by other algologists. Mr. Jordan showed a drawing of a specimen of Chordaria found in Penikese harbor, two of whose branches were, to all appearances, Dictyosiphon, both to the naked eye and under the microscope. Unless the Dictyosiphon were parasitic, which on close examination seems impossible, or unless it be not identical with the plant described under that name in Europe he thought we must conclude that the two alleged species are but different forms of *Chordaria flagelliformis*.

Mr. Ingersoll mentioned some of the changes in the general forms of terns, in their growth. In the bird just ready to hatch the head is about as bulky as the whole body, and the distance from the commissure to the crown is nearly as far as to the occiput; the bill is short and thick, the eyes well forward, large and closed. The shoulders are tolerably narrow and the body widens and thickens posteriorly. The legs are long in proportion, lack color and rigidity, and seem fat and useless. The body is covered with flexible, hair-like tubes instead of feathers, which, however, indicate in their areas of growth the pterylography of the species. At birth changes begin which culminate in maturity. The bill becomes long, attenuated and sharp at the tip, until it measures from commissure to tip twice the distance from commissure to

occiput. The bill is now bright red with more or less black about the tip. The black tip is apparent in the embryo, but the red does not appear till the bird is ready to fly, and then but faintly. . Meanwhile the top of the head flattens till the angle between it and the culmen is almost lost; so that the longest diameter of the head is the horizontal. The neck is still long and slender, but in the body the main bulk is anterior between the shoulders, and not in the hinder part of the body where the yolk is absorbed, as in young birds. The breast bone gradually increases in strength and the keel assumes its large proportions by the time of maturity.

Mr. J. Tingley asked if the colors could be preserved in starfishes. Prof. Agassiz replied that certain shades of color were more evanescent than others, but in the end all would disappear. Specimens preserved in glycerine or alcohol would preserve their colors for a short time. It was not known to what the colors were due; and this was true of all marine animals. Color, in some fishes examined, was found to be due to different oils accumulated in distinct cells, and different tints arose from the grouping of certain cells. The Professor said further that nothing could be more beautiful under the microscope than these pigment cells, and it was easy to obtain them — only take a little piece of colored skin. He had forty folio colored plates of one species from the embryo, where the pigment cells were few, up to older specimens where they were crowded one behind the other, and he had seen them in very many conditions, yet he had not come to the end of the story. The different tints were, he supposed, owing to different oxidation; at any rate the colors seemed to be different conditions of an identical substance.

At the recent meeting of the American Association for the Advancement of Science held in Portland, Maine, from Wednesday, August 20th to Tuesday, the 26th, one hundred and fifty-seven papers were entered on the general list. Abstracts were received of all but nine and were referred to the sectional committees who allowed most of them to be read; a number that were read, however, were not approved by the committees for publication. This careful discrimination is yearly becoming more necessary in order to keep up the character of the papers accepted for publication and to keep the limits of the volume within the means of the Asso-

ciation, though it would be a subject for great regret if funds were not at hand for the printing of every paper that advanced science.

The very opportune donation of one thousand dollars by Mrs. Elizabeth Thompson, the first patron of the Association, will allow the commencement of a new series of publications of papers embodying original research, thus enabling the committee to show especial honor to such papers. Seventy-seven of the papers presented were referred to Section B (natural history) and many of them were of first rank in scientific importance.

The general character of the meeting was decidedly scientific, and the discussions, though sometimes sharp, were carried on with a general good feeling and no personalities arose to mar the good nature of the meeting. The rooms of the City Building, where all the meetings were held, were all that could be desired. The Local Secretary and a few other members of the Local Committee were indefatigable in their efforts to make the meeting pleasant and successful so far as the local arrangements were concerned. It must be confessed, however, that the social element and the sympathy of the citizens generally with the objects of the Association were far less than at any previous meeting which we have attended. The lunch given by the ladies of Portland and the clam bake at Old Orchard Beach broke the ice a little, but that hearty entering of the citizens into the objects of the Association, which has characterized former meetings, was wanting. The excursions, by rail and steamer, after the adjournment, were much enjoyed by those able to remain and take part in them. About two hundred old members were present and one hundred and ten new members were elected. Prof. Lovering in his closing remarks as president made an eloquent speech and declared the twenty-second meeting closed at 11 o'clock A. M. on Tuesday, August 26th.

Among the important business transacted during the session was the report of a special committee on a revision of the Constitution, looking to a better carrying out of the objects of the Association. This report will come up for action at the next meeting which will be held at Hartford, Connecticut, on the second Wednesday of August, 1874.

The general officers of the next meeting are Dr. J. L. LeConte, President; Prof. C. S. Lyman, Vice President; Dr. A. C. Hamlin, General Secretary; Mr. F. W. Putnam, Permanent Secretary.